FOOTHILLS
DRAFT ENVIRONMENTAL IMPACT STATEMENT

COVER SHEET

Proposed Action: The Montana Department of Natural Resources and Conservation proposes forest management activities on forested State Trust Lands. The planned activities would include the sale and harvest of up to approximately 10 million board feet of wood products from 1468 acres or less of state land located east of Bigfork, Montana. Timber harvest would focus on salvaging dead and dying timber, improving the current or future productivity of forest stands in the project area, utilizing and/or improving an existing road system to better meet current and future road management needs in the project area, and ensuring the future forest stands meet the objectives of biodiversity and productivity for the benefit of the associated school trusts. Management activities would include harvest from as much as 1468 acres located in Sections 21, 27, 28, and 34 of Township 28 North, Range19 West and Sections 1, 2, 3, 10, 11, 14, 23, 24,35 and 36 of Township 27 North, Range 19 West. The proposed action plan would begin implementation as early as the summer of 2006.

Type of Document: Draft Environmental Impact Statement (DEIS)

Lead Agency: Montana Department of Natural Resources and Conservation (DNRC), Northwest Land Office, Kalispell Unit.

Responsible Official: Greg Poncin
Kalispell Unit
2250 Hwy 93 N
Kalispell, MT 59901-2557
406-751-2263

Further Information: Pete Seigmund
Kalispell Unit
2250 Hwy 93 N
Kalispell, MT 59901-2557
406-751-2266

Special Note: Comments received in response to this DEIS will be available for public inspection and will be released in their entirety if requested pursuant to the Montana Constitution.

HOW TO READ THIS DEIS (DRAFT ENVIRONMENTAL IMPACT STATEMENT)

To read this DEIS more effectively, carefully study this page. Following State regulations, we have designed and written this document (1) **to provide** the Project Decision Maker with sufficient information to make an informed, reasoned decision concerning the proposed Foothills Timber Sale and (2) **to inform** members of the affected and interested public of this project so that they may express their opinions to the Project Decision Maker.

The DEIS consists of the following chapters:

1 Purpose and Need for Action
2 Alternatives, Including the Proposed Action
3 Existing Environment
4 Environmental Effects
5 References

Chapters 1 and 2 together serve as a summary overview of the Foothills Timber Sale Project. These two chapters have been written so that non-technical readers can understand the potential environmental, technical, economic, and social consequences of **taking** and of **not taking** action.

Chapter 1 introduces the Foothills Timber Sale. It provides a very brief description of the proposed Foothills Timber Sale and then explains three key things about the project:

(1) the relevant environmental issues,
(2) the decisions that the Project Decision Maker must make concerning this project, and
(3) the relevant laws, regulations, and consultations with which the DNRC must comply.

Chapter 2 serves as the ***heart*** of this DEIS. It provides detailed descriptions of Alternative A: No Entry (No Action), Alternative B: High Salvage, and Alternative C: Low Salvage. Most important, it includes a **summary comparison** of the predicted effects of these two action alternatives on the human environment, providing a clear basis for choice between the alternatives for the Project Decision Maker and the Public.

Chapter 3 briefly describes the past and current conditions of the relevant resources (*issues*) in the project area that would be meaningfully affected, establishing a part of the baseline used for the comparison of the predicted effects of the alternatives.

Chapter 4 presents the detailed, analytic predictions of the consequences of implementing Alternative A: No Harvest (No Action), Alternative B: High Salvage, or Alternative C: Low Salvage. These predictions include the direct, indirect, short term, long term, irreversible, irretrievable, and cumulative effects of implementing the alternatives.

Chapters 5 lists preparers, references, and abbreviations used.

TABLE OF CONTENTS

CHAPTER 1: PURPOSE & NEED

1.1 DESCRIPTION OF PROPOSED ACTION

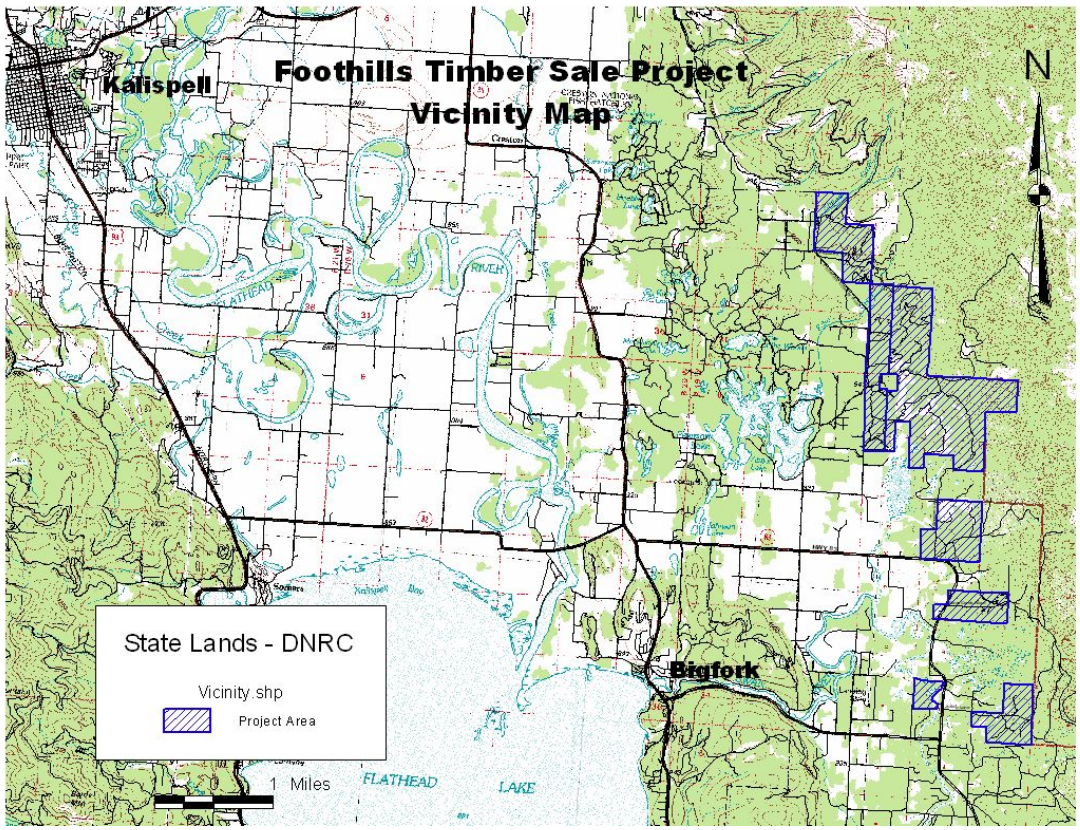
The Kalispell Unit, Montana Department of Natural Resource and Conservation (DNRC) is proposing the Foothills Timber Sale Project on state school trust lands northeast of Bigfork. The project proposes:

- Timber harvesting
- Drainage improvements on roads
- Road relocation and/or new construction
- Road closures and abandonment
- Reforestation activities

If a harvest alternative were selected, an estimated 7 to 10 million board feet of timber would be sold and harvested. This volume would be harvested from approximately 1156 to 1468 acres. Existing stream crossings would be improved as needed for the selected alternative. Approximately 600 acres or less would initiate new forest stands using natural seeding or hand planting of conifer seedlings.

The project area is comprised of approximately 4800 acres and is located approximately five miles northeast of Bigfork, Montana. It is located within Sections 21, 28, 27, and 34, T28N, R19W and Sections 1, 2, 3, 10, 11, 14, 23, 24, 35, and 36, T27N, R19W. State Trust Lands within the project share property boundaries of approximately 5.5 miles with United States Forest Service (USFS) and 20 miles with private landowners (Figure 1, Foothills Timber Sale Project Vicinity Map). Several other analysis areas were delineated to assess direct, indirect and cumulative effects of the alternatives considered. More specific details about these are contained under each corresponding resource heading in Chapter 3.

Figure 1. Foothills Vicinity Map



1.2 NEED FOR ACTION

The lands involved in the proposed project are held by the State of Montana for the support of specific beneficiary institutions, such as public schools, State colleges and universities, and other specific State institutions, such as the school for the deaf and blind (Enabling Act of February 22 1889: 1972 Montana Constitution Article X, Section 11). The Board of Land Commissioners (Land Board) and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions, Section 77-1-202, Montana Code Annotated (MCA).

On June 17, 1996, the Land Board approved the State Forest Land Management Plan (SFLMP). The SFLMP provides the philosophy adopted by DNRC through programmatic review (DNRC, 1996). The DNRC will manage the lands in this project according to this philosophy, which states:

> *Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biological diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream… In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.*

On March 13, 2003, the DNRC adopted Administrative Rules for Forest Management (Rules) (Administrative Rules of Montana [ARM] 36.11.401 through 450, DNRC 2003). The Rules provide DNRC personnel with consistent policy, direction, and guidance for the management of forested trust lands. Together, the SFLMP and Rules define the programmatic framework for this project.

1.3 OBJECTIVES OF THE FOOTHILLS TIMBER SALE PROJECT

In order to meet the goals of the management philosophy adopted through programmatic review, the DNRC has set the following specific project objectives:

Roads: Develop a manageable, maintainable road system with the minimum number of road miles that a) provides appropriate access for short and long term management and use of these trust lands, and b) improves surface drainage and stream crossings on existing roads.

Timber: Manage for long-term productivity through silvicultural treatments that: a) promote the retention and/or regeneration of western white pine, western larch, and other seral species appropriate for the sites (desired future conditions, ARM 36.11.405), and b) increase stand vigor and reduce the amount of insect infested or disease infected trees.

Economics: Produce net revenue for the Trust. Harvest 7 to 10 MMBF of wood products to generate revenue for the appropriate school trusts and provide a sufficient amount of sawlog volume to contribute to the sustained yield for DNRC, as mandated by State Statute 77-5-222, MCA.

1.4 COOPERATING AGENCIES AND ENTITIES WITH JURISDICTION AND REQUIRED PERMITS

Montana Fish, Wildlife and Parks (FWP): FWP has jurisdiction over the management of fisheries and wildlife in the project area. A Stream Preservations Act Permit (124 Permit) is required from FWP for activities that may affect the natural shape and form of any stream or its banks or tributaries.

Montana Department of Environmental Quality (DEQ): A Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization) may be required if:

- Temporary activities would introduce sediment above natural levels into streams, or
- FWP determines a permit is necessary after reviewing the mitigation measures in the 124 Permit.
- Montana Airshed Group: DNRC is a member of the Montana Airshed Group, that regulates slash burning done by DNRC. DNRC receives air-quality permits through participation in the Montana Airshed Group.

F.H. Stoltze Land & Lumber Co: Cooperative road-maintenance activities by DNRC and Stoltze Land & Lumber Company occur on "cost-share" roads to reduce sediment delivery from roads.

United States Forest Service (USFS): DNRC is in the process of amending a USFS/State of Montana easement and other road use agreements for specific road segments on Strawberry Lake Road, Jewel Basin Road, Road 2B and Road 14E within the project area.

1.5 OTHER RELEVANT ENVIRONMENTAL REVIEWS IN THE AREA

In order to address direct, indirect, and cumulative effects on many resources, the analysis incorporates past, present, and future actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (grizzly bear, Canada lynx, etc.) and are further described by resource in Chapters 3 and 4. Effects from past projects are incorporated into DNRC databases over time and become part of the existing condition that is used in each analysis. Ongoing and proposed projects are considered for each resource based on the appropriate analysis area.

The following timber sales are located within the Kalispell Unit jurisdictional boundary.

- The Wild Horse Mountain Timber Sale Environmental Assessment (DNRC, 2004) is an upcoming sale for which environmental analysis has been completed.
- The Cliff Lake timber sale project has been identified on DNRC's 3-year timber sale list as the next potential project for Kalispell Unit. Currently, no proposal/proposed action has been defined and the potential project has not been scoped; therefore, DNRC has not initiated a pre - impact study on this proposal.

1.6 DECISIONS TO BE MADE

Following publication of the Final Environmental Impact Statement (FEIS), the Kalispell Unit Manager will review public comments, the FEIS, and information contained in the project file. No sooner than 15 days after publication of the FEIS, the Unit Manager will consider and determine the following:

- Do the alternatives presented in the FEIS meet the project's objectives?
- Are proposed mitigations adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented and why?

These decisions will be published and all interested parties will be notified. The decisions in the published documentation would become DNRC's recommendations to the Land Board. The Land Board will make the final decisions regarding implementation of actions.

1.7 SCOPE OF THE ENVIRONMENTAL ANALYSIS

This section defines and explains the scope (boundaries/limits) of the Foothills Timber Sale Project. It briefly describes the history of the planning process, identifies the resource issues studied in detail, and identifies the issues eliminated from detailed study.

1.7.1 History of the Foothills Planning Process

This Draft Environmental Impact Statement (DEIS) was prepared in accordance with the Montana Environmental Policy Act (MEPA), which requires State government to include the consideration of environmental impacts in its decision making process. Agencies are also required to inform the public and other interested parties about proposed projects, environmental impacts that may result, and alternative actions that could achieve the project objectives. Planning for this project began in May 2001.
Public scoping for the Foothills Timber Sale Project was initiated in May 2001 with a letter to known interested parties. In June 2001, DNRC solicited additional public participation in the Foothills Timber Sale Project proposal by placing notices in the Kalispell's Daily Interlake and Bigfork Eagle newspapers. The mailing list developed for this project is in the project file. The public comment period for the initial project proposal was open for 30 days. A field trip for interested parties was conducted in September 2001.

The Interdisciplinary Team (ID Team), made up of DNRC's wildlife biologist, hydrologist, and several foresters, began compiling the issues and gathering information related to current conditions in the spring

of 2001. Final issues were defined in November and December of 2001. During 2002 some work was conducted on developing alternatives and initial work on Chapter 4 analysis and fieldwork.

Fire activity requiring project personnel to focus on protection activities throughout the state during 2002 and 2003 delayed the project. Planning for this project was resumed in May of 2004. In April 2005, a newsletter presenting the action alternatives was distributed to update interested parties and solicit further input prior to the DEIS. Public review of a DEIS is likely to occur during November 2005 with the FEIS published in early 2006.

As a result of the letters and notices in the newspapers approximately 81 letters and phone calls were received. The issues and concerns identified through public scoping were summarized and used to further refine the project.

1.7.2 Issues Studied in Detail

The Foothills ID team carefully considered comments received from DNRC resource specialists, the public, and other agencies. Through the scoping process, concerns were raised about the project's potential impacts on the environment. These comments and concerns were considered by DNRC in the development of project alternatives (see CHAPTER 2). The Project File contains additional details of scoping and issue identification. For the purposes of this environmental analysis, issues will be considered actual or perceived effects, risks, or hazards as a result of the proposed alternatives. The ID team determined that the following issues are relevant to the decisions that must be made concerning the Foothills Timber Sale Project. Further, these issues directly influenced the technical design of the project.

Issues were grouped by general resource area (Vegetation, Watershed, etc.) and are listed below. Following the concerns received for each area is a brief description of how the concern will be addressed in terms of effects analyses in this EIS.

Vegetation

Development of alternatives and silvicultural prescriptions included careful consideration of concerns. In order to evaluate effects on vegetation, the following issues related to vegetation were included for detailed study in Chapters 3 and 4:

- Timber harvesting and associated activities may affect forest stand characteristics and in regards to forest composition, age, and succession.
- Timber harvesting and associated activities may affect the distribution and amount of old growth stands.
- Timber harvesting and associated activities may affect the distribution and amount of western hemlock stands.
- Timber harvesting and associated activities may affect stand structure and development.
- Insects and disease may affect timber productivity and value.
- Timber harvesting and associated activities may affect the distribution and vigor of sensitive plants.
- Timber harvesting and associated activities may increase noxious weeds in the project area.

Watershed and Hydrology

The following issues regarding watershed and hydrology are studied in detail:

- Forest management activities may degrade water quality in streams and the Swan River.
- Cutting near streams may increase runoff, bank erosion, and sedimentation.
- Additional cutting may raise water table and increase area of saturated ground.

These concerns were addressed in part through alternative development. Either action alternative would incorporate Forestry Best Management Practices and follow all Streamside Management Zone Laws and Rules. Potential impacts to water quality and water yield are addressed in Chapters 3 and 4.

Fisheries

During scoping, a concern was received that the forest management activities might affect fisheries, including habitat for west slope cutthroat trout. In addition, there were internal concerns about the potential impacts to fish populations and habitat. The issue of fisheries will be discussed in detail in Chapters 3 and 4, with effects analyses focused on:

1. Fish populations.
2. Fish habitat features, including:
    - Flow regime
    - Sediment
    - Channel forms
    - Riparian function
    - Large woody debris
    - Stream temperature
    - Connectivity

Soils

The following concerns about soils were expressed during scoping:

- Soil productivity and stability may be adversely affected by forest management activities, especially near wetlands and streams.
- Erosion may increase as a result of timber harvest activities.
- Cutting near streams may increase runoff, bank erosion, and sedimentation.

Existing conditions and potential impacts to soils are described in Chapters 3 and 4.

Wildlife

During the initial scoping and subsequent newsletter comment period, the following issues were expressed regarding the effects of the proposed project:

- Timber harvests could reduce forested patch size and connectivity, thereby reducing habitat for species that use forest stands.
- Timber harvests and road construction/reconstruction might result in “rampant” use by off-road vehicles.
- Timber harvests and associated activities might affect black and grizzly bears, wolf, elk, lynx, big game, and other wildlife species that inhabit the project area.
- Timber harvests and associated activities might reduce habitat quality and security for wildlife and fish species, including grizzly bear, lynx, mountain lion, white-tailed deer, and other big game.
- Changes in road management might decrease grizzly bear and other wildlife security in important habitats.
- Timber harvests in the hemlock and grand fir stands might decrease plant and animal diversity.
- Timber harvests might result in large opening that are harmful to wildlife.
- Timber harvests and associated actions might sever travel corridors, some of which occur along stream courses.
- Timber harvests might increase forage, resulting in increased habitat quality for big game in an area with high damage concerns.
- Access management might reduce hunter access in an area where FWP is trying to reduce population by increasing harvests.
- Changes of access might affect grizzly bear mortality.
- Timber harvests in section 35 and along the Swan River might decrease habitat for wildlife, including eagles, fox, deer, wood ducks, grizzly bears, and wild turkeys.
- Diversity and abundance of wildlife species may diminish with changes in forest stand conditions from timber harvest activities. Wildlife species to consider should include: grizzly bear, Canada lynx, bald eagle, black bear, mountain lion, white-tailed deer, elk, osprey, wild turkey, wood ducks, and fox.

    - Note: The wildlife analysis considers the effects of each alternative on threatened, endangered, sensitive species, and big game species in a fine filter analysis, while general habitat conditions described in a coarse filter analysis are used to broadly analyze the effects of other more common native species such as black bears, mountain lions, ospreys, wild turkeys, wood ducks and foxes.
- Habitat quality and security for wildlife species inhabiting the area may be adversely affected by timber harvest activities and road management.
    - This issue is analyzed under the connectivity analysis in the coarse filter analysis, while road management effects are discussed under grizzly bear and big game analyses.
- Timber harvest activities may disrupt or sever grizzly bear and other wildlife travel corridors, especially along Patterson Creek and the Swan River.
    - The effects are analyzed under the connectivity and grizzly bear analysis.
- Increases in road densities as a result of harvest activities could result in increase in grizzly bear/ human encounters or grizzly bear mortality.
    - The effects are analyzed under the grizzly bear analysis.
- Openings created in tree canopy by timber harvest may harm wildlife habitat
    - This issue is analyzed under the semi-closed and closed canopy forested habitat and connectivity portions of the coarse filter analysis.
- Openings created in tree canopy by timber harvest may increase already high deer populations
    - The effects to big game area discussed in the big game section.

In addition to the above issues, the analyses in Chapters 3 and 4 discuss other environmental effects of the alternatives to the wildlife resource.

Air Quality

During scoping the concern was expressed that log hauling on native surface roads may produce levels of dust that reduce air quality in the vicinity of residences. This issue will be analyzed in terms of effects on air quality due to dust produced from log hauling and smoke produced from burning slash.

Aesthetics

The concern was raised that forests management activities may affect aesthetics in the project area, in regards to visual scenery, quiet, and proximity to wilderness. These concerns were addressed in part through alternative development. The effects to aesthetics will be analyzed in Chapters 3 and 4.

Recreation

During scoping, the following concerns were raised:

- Timber harvesting and associated logging road management may result in fewer miles of road suitable for recreational uses typically occurring in the Foothills area, such as biking (motorized & non-motorized bikes and ATV's), hiking, snowmobiling, skiing, and hunting.
- Skid trails and roads associated with timber management activities in conjunction with more open timber stands may increase the number of violations of general recreational use rules for state land.
- Timber harvesting and associated logging road management may affect the feasibility or desirability of the Bigfork Community Nordic Center to continue leasing a portion of the Foothills area for groomed cross-country ski trails.

These concerns were addressed through alternative development. Potential impacts to recreation will be analyzed in Chapters 3 and 4.

Economics

During the public scoping process, a number of concerns were expressed about economics. The issue was raised that each of the alternatives may affect revenue to the trust, local employment and income, and other uses of the area. These components of economics and potential impacts are analyzed in Chapters 3 and 4.

1.7.3 Issues Eliminated from Detailed Study

The ID team eliminated the following issues from detailed study because they were beyond the scope of this project or because this project would not be likely to impact them. The Project File contains details dealing with these issues. This Environmental Impact Statement contains no further or minimal information on these eliminated issues.

1.7.3.1 Historical, Cultural, and Archaeological Sites

The DNRC archaeologist requested the State Historic Preservation Officer to conduct a search of the Cultural Resource Inventory System and Cultural Resources Annotated Bibliography System databases. The results of those searches indicated that cultural or paleontologic resources have not been identified in the project area. It is the position of the DNRC that the presence of Heritage Properties in the area of potential effects in unlikely.

1.7.3.2 Road Safety

During the public scoping process a concern was expressed that log hauling on the Foothills County Road would "mar and roughen travel way". Since this is a County Road, it is beyond the authority and jurisdiction of the DNRC to impose restrictions on the use of a public road. Under any of the alternatives, all commercial traffic will follow the proper rules and regulations pertaining to use of County and State roads.

1.7.3.3 Fire

The following concerns related to wildland fires were raised during the public scoping:

- Slash created from logging may increase fuel loadings increasing the fire hazard.
- More open tree canopy resulting from logging may result in dryer sites that increase fire danger
- Fuel modification treatments may not result in improved ability to control or suppress fires near homes.
- DNRC should help landowners apply fuel modification near homes "where it will do the most good".
- Current stand conditions are viewed as a fire hazard and at risk of large, catastrophic fire if ignition occurs.
- Increased road access may result in higher risk of human caused fires.

These concerns will be mitigated through standard DNRC operating procedures or are very unlikely to occur. The DNRC will meet State Hazard Reduction Law requirements and treat all logging slash to meet the standards in the law. High hazard fuel reduction is required within 100 feet of homes and open roads. Removal of overstory trees resulting in a more open tree canopy would cause the soil to become wetter rather than drier due to decreased transpiration rates once the stocking is reduced (refer to water yield information in Sections 3.2 and 4.2 of this DEIS). Hazard reduction requirements will address the above ground fuels that would dry out or contribute to fire danger. The proposed project would decrease road access by implementing more effective road closures. For more details about stand structure, development, and fire regimes, refer to vegetation information in sections 3.1 and 4.1 of this DIES.

1.7.3.4 Regeneration

A concern was raised that regeneration of harvest units may not be successful, based on observations of difficult regeneration efforts in older seed tree and clear cut units in the analysis area. This issue was addressed through alternative development, which included careful consideration of regeneration requirements. Past clearcutting has occurred within the project area with varied regeneration success. In the last 50 years approximately 638 acres have been regenerated with clearcut harvests; 476 of those acres are stocked and 162 acres (25%) are not fully stocked. Under either action alternative, regeneration goals would be addressed by natural and planted regeneration. Planted species would include western white pine, western larch, ponderosa pine or Douglas-fir. In planted stands, a survival survey would be completed the first fall after planting to identify the need for follow up treatments. DNRC would complete regeneration surveys in naturally (not planted) regenerated stands.

1.7.3.5 Retention of Seral Species

The suggestion was made to favor the retention of seral species especially western white pine and western larch. This suggestion was incorporated to each of the action alternatives. Effects to cover types and other vegetation characteristics are described in detail in section 4.1 of this document.

1.7.3.6 Increase Access for Firewood Cutting

The suggestion was made to open currently closed roads to allow for firewood cutting. Under any of the alternatives, firewood cutting would continue to be allowed after appropriate review and the issuance of a permit. DNRC will continue to balance management access with road maintenance costs and wildlife considerations.

1.7.3.7 Gall Rust

In early scoping for this project, the concern was expressed that gall rust in lodgepole pine regeneration at Bear Creek needs to be controlled, so that private timber stand can be managed. This issue was addressed and resolved in a separate precommercial thinning project in 2004.

1.7.3.8 Canada Lynx

The concern was raised that timber harvests and associated activities might reduce habitat quality and security for Canada lynx. Canada lynx are listed as “threatened” under the Endangered Species Act. The project area includes approximately 595 acres of cover types used by lynx scattered in relatively small patches. Of these patches, 460 acres are currently modeled as temporarily unsuitable habitat, while the remaining 135 acres could presently be contributing to lynx habitat. The areas that are potentially providing lynx habitat occur near the eastern boundary of the project area adjacent to National Forest Service lands. None of these stands are proposed for harvesting. In addition, all these stands lie on big game winter range, thereby further reducing the potential of lynx use in the project area due to predation and competition from other predators. Based on the above information, this project is not likely to affect lynx or their habitat, therefore Canada lynx will not be considered further in this EIS.

CHAPTER 2: ALTERNATIVES

2.1 INTRODUCTION

Chapter 2 describes the alternatives developed and considered for the Foothills Timber Sale Project. This chapter will introduce a no action alternative and two action alternatives. It contains summaries and comparisons of the actions and predicted effects of each alternative, based on the detailed environmental analysis in Chapters 3 and 4.

2.2 DEVELOPMENT OF ALTERNATIVES

An Interdisciplinary (ID) Team was formed in the spring of 2001 to work on the Foothills Timber Sale Project. The role of an ID Team is to summarize issues and concerns, develop management options within the project area, and analyze the potential impacts of a proposal on the human and natural environments.

DNRC began reviewing resources in this area prior to 1999. Data was collected for resources within the project area to aid in the analyses of wildlife habitat, hydrology, fisheries, old-growth timber stands, timber-harvest feasibility, transportation systems, and economics. Data was also used to develop mitigation that could be applied to the proposal.

Foresters provided the ID Team with a harvest and road proposal to accomplish and meet the desired future forest conditions on Kalispell Unit and the objectives described in *CHAPTER I – PURPOSE AND NEED.* The proposal addresses management of the extensive, low standard road system and numerous timber stands currently experiencing a reduction in timber productivity and diminishing tree species diversity. The timber sale proposal also provides an opportunity to regenerate new stands of timber similar to the results of a wildfire. The ID Team further developed the proposal within the framework of the SFLMP and its administrative rules. The ID Team discussed how to address both public and internal issues, mitigations required by the SFLM Rules, and additional mitigations that may be implemented to reduce or minimize effects related to the project.

Issues related to road management, the cost of road improvements and timber value loss of diseased and dying trees resulted in the development of Action Alternatives B and C. Alternative B pursues improvement of long term timber productivity on a higher proportion of deteriorating stands, while Alternative C defers a higher proportion of road improvement and development costs to a later date – treating fewer acres and requiring less road access.

The change in timber stand attributes from harvesting is a public concern, especially for residential property owners adjacent to trust lands. The large extent of trust land in the Foothills project area abutting private property initiated much local interest regarding where harvest units would be located and the type of cutting proposed. For this reason a newsletter with maps depicting harvest unit locations, type of harvest, and brief descriptions of the various harvests for both action alternatives was issued to interested parties in April 2005. This newsletter also reminded the public of their ability to request a "Timber Conservation License in lieu of sale" as allowed under 77-5-208 MCA and (ARM 33.11.451 – 456). To date, one notice of intent has been filed with DNRC for a 100 foot wide "no cut strip adjacent to their property. The area of request is proposed for treatment in both action alternatives, so the Timber Conservation License option was incorporated as part of either alternative.

2.3 ALTERNATIVE DESCRIPTIONS

This section describes the elements and mitigation measures of the action alternatives B and C, and also includes a description of No Action Alternative A. Actions designed to protect resources during harvesting, road construction, or site preparation activities would be incorporated into a timber sale contract as contract specifications and stipulations. These specifications and stipulations would be applied to an action alternative and are a form of mitigation. Mitigation measures that were designed to reduce impacts on a particular resource are discussed in section 2.3.3 of this chapter and in Chapters 3 and 4 under the particular resource.

2.3.1 No Action Alternative A

No Action Alternative A is used as a baseline for comparing the effects that the action alternatives would have on the environment. It is also considered a reasonable alternative for selection.

Timber harvesting as proposed would not occur. Firewood cutting and gathering would continue on an annual basis. Intermittently, small quantities of wood products would continue to be sold and removed from small areas. Salvage logging and removal of hazard trees within easements or residential leases would continue.

Temporary roads would not be built and restricted roads would not be reconstructed at this time. Maintenance mostly in the form of re-establishing road closures or installation of additional road closures would continue, as funding and priorities allow. The Birch Creek stream crossing would not be rehabilitated at this time.

Recreational uses of the area, both general and special would continue to include hiking, biking, ATV riding, shooting, hunting, horseback riding, Nordic skiing, and snowmobiling. Efforts to curtail vandalism or resource damage associated with unauthorized recreational use would continue as funding and priorities allow.

Fuels mitigation and weed control efforts would continue as funding and priorities allow.

Forest and plant succession would continue to be mainly influenced by the occurrence of natural events, such as insects and disease outbreaks, windthrow, or wildfire. Understory plant succession and to a lesser degree forest succession on leased sites used for grazing and home sites would continue to be mainly influenced by these uses in a forested setting.

Processing of the application for a timber conservation license on 1.2 acres in the E ½ SW ¼ Section 24, T27N, R19W would terminate with the selection of No Action Alternative A.

2.3.2 Components Common to Action Alternatives B & C

Both action alternatives are designed to improve timber stand productivity within the Foothills analysis area, as a necessary means for providing revenue generating opportunities in the future, while limiting present logging and road development costs. Timber harvesting focuses on mostly decadent stands dominated by grand fir that historically contained a larger component of western white pine, western larch, ponderosa pine, and/or Douglas-fir. Both alternatives strive to move timber stands toward a more healthy and vigorous condition while maintaining or promoting the establishment of desired forest species. Silvicultural treatments designed for meeting the above objective include mostly regeneration harvest for older stands and intermediate harvest for younger stands.

Silvicultural Treatments (Timber Management):

- ***Overstory Removal (intermediate cut) –*** This treatment would remove the widely spaced overstory (seed) trees left from a previous harvest, with the exception of those that would be retained to meet snag and snag recruitment rules. The overstory trees exist above a well stocked stand of conifer saplings that became established after the removal of most of the overstory trees in the previous harvest. The understory stand of conifer saplings would be protected from logging damage and managed to produce wood products and revenue in the future.

- ***Commercial Thin (intermediate cut) –*** Commercial thinning would reduce tree stocking levels in stands or groups of trees that are healthy, vigorous, and generally less than 100 years old. The thinning is designed to promote continued vigorous growth of western larch and western white pine trees. The stands or groups would be fully stocked after harvest, but would have a more open tree canopy. Spacing between leave trees would be fairly regular, approximately 20 to 40 feet between stems, allowing the crowns of leave trees to develop more fully and sustain tree growth and vigor.

- ***Improvement Cut (intermediate cut) -*** The improvement cut is designed to leave the most vigorous and healthy trees at a stocking level that provides for continued crown development and diameter growth, while removing diseased, suppressed, defective, or insect infested trees. The incidence of insect and disease is higher in these stands, than those proposed for commercial

thinning and tree age generally has a wider range. Spacing is more variable than in the commercial thinning described above. Some openings in the tree canopy would occur depending on the availability of healthy trees. Western larch, western white pine, ponderosa pine, Douglas-fir, lodgepole pine, and spruce would be favored for leave, while the majority of grand fir would be harvested.

- ***Shelterwood (regeneration harvest) –*** This treatment is designed to retain healthy western larch, ponderosa pine, Douglas-fir, and western white pine as a natural seed source for establishment of a new forest stand. Retention would be 10 to 30 trees/acre, depending on availability. Cutting would be followed by machine scarification to prepare the site for natural regeneration and hand tree planting seral species such as western white pine, western larch, ponderosa pine, or Douglas-fir.

- ***Clearcut or Seed Tree (regeneration harvest) –*** Few healthy trees of any species exist in these stands. Healthy western larch, western white pine, ponderosa pine or Douglas-fir would be retained as seed trees, resulting in 1 to 10 trees/acre retained. This treatment is designed to harvest the dead and dying grand fir and establish a new forest stand with a component of the seral tree species noted above. Cutting would be followed by machine scarification or prescribed burning to prepare the site for natural regeneration and hand tree planting seral species – to include western white pine, western larch, ponderosa pine, or Douglas-fir.

Both action alternatives are designed to utilize the existing transportation system as much as possible. Road improvements would focus on improving haul roads to meet BMP standards and enhancing road closure effectiveness. Road improvements and closures are identical under Alternative B and C for Sections 28, T28N, R19W and Sections 3,10,14, 24,35, & 36, T27N, R19W. Improvements include the rehabilitation of the Birch Creek stream crossing site on Road 2B in the NW ¼ of Section 2, T27N, R19W. Existing culverts would be removed and replaced with permanent bridge footings for placement of a temporary, portable bridge during periods of road use. Both alternatives replace or repair undersized culverts on a portion of the Jewel Basin Road and Road 2A, close the road system and construct a small parking lot adjacent to Fern Lane in Section 35, T27N, R19W and rehabilitate a parking area adjacent to the Jewel Basin Road in the NW ¼ NE ¼ Section 3, T27N, R19W after use.

Both alternatives are based on the trust mandate, principles of the State Forest Land Management Plan and the associated Forest Management Rules, as well as other laws and/or rules applicable to timber harvesting activities. These alternatives would, in the long term, move timber stands toward a desired age class, density, species composition, and structure. Harvesting in combination with fuel treatments would decrease the potential risk of crown fires and fuel build up adjacent to residential properties.

2.3.3 Mitigation Measures Common to Action Alternatives B & C

The following mitigations would be required under either action alternative:

Vegetation

- Grass seed new and disturbed roads and landings; spot spray new weed infestations
- Washing logging equipment prior to use.
- Trample slash in skid trails
- Treating existing weed populations along or within roads with herbicide spray.

Watershed and Soils

- Upgrade roads to incorporate Forestry Best Management Practices (BMPs)
- Limit timber harvest activities to time when ground is frozen or soil moisture is below 20%

Fisheries

- **Habitat – Sediment and Channel Forms**
    - Apply all applicable Forestry Best Management Practices (including Streamside Management Zone Law and Rules) and Forest Management Administrative Rules for soils riparian management zones.
    - Monitor all road-stream crossings for sedimentation and deterioration of road prism.
    - Only allow equipment traffic at road-stream crossings when road prisms have adequate load-bearing capacity.

- **Habitat – Riparian Function, Large Woody Debris, and Stream Temperature**
    - Apply all applicable Forestry Best Management Practices (including Streamside Management Zone Law and Rules) and Forest Management Administrative Rules for fisheries riparian management zones to fish-bearing streams in the project area.
    - Krause Creek: Immediately adjacent to proposed harvest units, establish the outside edge of the fisheries riparian management zone at 90 feet from the nearest bankfull edge of the stream channel. Within the fisheries riparian management zone provide adequate large woody debris recruitment and stream shading by implementing the Streamside Management Zone Law and Rules for Class 1 streams.
    - Birch Creek: Immediately adjacent to proposed harvest units, establish the outside edge of the fisheries riparian management zone at 101 feet from the nearest bankfull edge of the stream channel. Within the fisheries riparian management zone provide adequate large woody debris recruitment and stream shading by (1) creating a no-cut buffer from the nearest bankfull edge of the stream channel out to 25 feet and (2) harvesting a maximum of 50 percent of trees greater than 8 inches in diameter at breast height from 25 feet out to 101 feet.
    - Wolf Creek: Immediately adjacent to proposed harvest units, establish the outside edge of the fisheries riparian management zone at 91 feet from the nearest bankfull edge of the stream channel. Within the fisheries riparian management zone provide adequate large woody debris recruitment and stream shading by (1) creating a no-cut buffer from the nearest bankfull edge of the stream channel out to 25 feet and (2) harvesting a maximum of 50 percent of trees greater than 8 inches in diameter at breast height from 25 feet out to 91 feet.
    - Swan River: Immediately adjacent to proposed harvest units, establish the outside edge of the fisheries riparian management zone at 93 feet from the nearest bankfull edge of the stream channel. Within the fisheries riparian management zone provide adequate large woody debris recruitment and stream shading by creating a no-cut buffer from the nearest bankfull edge of the stream channel out to 50 feet.
    - Apply Streamside Management Zone Law and Rules to all non-fish bearing streams in the project area.
- **Habitat – Connectivity**
    - Install temporary bridges at specified road-stream crossing sites of Birch Creek and Patterson Creek.

Wildlife

- Maintain a minimum of 2 snags and 2 snag recruitment trees over 21 inches dbh per acre, on average, for all harvest units. If unavailable, retain the next largest size class. Additional snag resources could be retained within the harvest units.
- Retain 10-15 tons CWD post harvest.
- Retain cover around riparian areas and favorable foraging locations for bears.
- Retain a 100’ visual screening buffer along open roads.
- Prohibit contractors from carrying firearms on restricted roads.
- If a wolf den or rendezvous site were identified, operations would be suspended within 1 mile or 0.5 mile, respectively.
- Reduce open road density following completion of the project through road closures.
- During the harvest activities, restrict public motorized access along restricted routes through signing when operations are active and closure devices when operations are inactive (nights, weekends, shutdown periods).
- Protect submerchable trees, brush, some cull material and non-commercial trees would occur in select areas that have potential for high levels of human activity to provide visual screening cover for grizzly bears and big game species.
- Construct parking areas and post interpretive signs to increase compliance with road restrictions.

2.3.4 Conservation License in Lieu of Timber Harvest

During the development of the Foothills Timber Sale Project, the Department of Natural Resources and Conservation received an application for a timber conservation license in lieu of harvest in a portion of the project area. This license would include a 10-year deferral of harvest on approximately 1.2 acres of trust land in the E ½ SW ¼ Section 24, T27N, R19W. This area is within proposed harvest unit B1 for both Action Alternatives. Under the license, the DNRC would maintain some forest management rights, and would continue other uses within the area.

The option of this conservation license will be included as a component of either Action Alternative. The deferred harvest would be incorporated into the normal sale bidding process, and the applicant would be required to bid on that volume. The license would be issued if the applicant were to have the highest bid.

2.3.5 Action Alternative B

Action Alternative B would apply silvicultural treatments to 1,468 acres, harvesting approximately 9 MMBF of timber. Regeneration harvests would be used to treat 843 acres, and intermediate harvests would be used to treat 625 acres. The various types of cutting are explained under the Silvicultural Treatment section above and Figure 2 – 1 displays harvest unit location and type of silvicultural treatment or cutting that would be applied.

This alternative would treat the greatest amount of acres and require more extensive road use and construction. To access harvest units and improve transportation systems, 44.5 miles of road would be used. Approximately 35.1 miles requires maintenance or reconstruction. New construction of permanent road would be limited to 1.1 mile; approximately 1.8 miles of new temporary road construction would be required; 15.8 miles would be reconstructed prior to use, and 18.2 miles would be closed after use. Road closures or abandonment would reduce open road status in the project area by approximately 10.5 miles. Up to 6 parking areas would be constructed or improved to provide better access for non-motorized recreation.

2.3.6 Action Alternative C

Action Alternative C would apply silvicultural treatments to 1,156 acres, harvesting approximately 7 MMBF of timber. Regeneration harvests would be used to treat 531 acres, and intermediate harvests would be used to treat 625 acres. The various types of cutting are explained under the Silvicultural Treatment section above and Figure 2 -2 displays harvest unit location and type of silvicultural treatment or cutting that would be applied.

This alternative treats fewer acres, requiring less extensive road use and construction. To access harvest units and transportation systems, 38.7 miles of road would be used. Approximately 29.3 miles requires maintenance or reconstruction. New construction of permanent road would not be required under this alternative; approximately 1 mile of new temporary road construction would be required; 13.7 miles would be reconstructed prior to use, and 17.0 miles would be closed after use. Road closures or abandonment would reduce open road status in the project area by approximately 10.5 miles. Up to 6 parking areas would be constructed or improved to provide better access for non-motorized recreation.

Figure 2-1. Alternative B Harvest Units. Map Abbreviations are CC: clearcut, ST: seedtree, CT: commercial thin, OSR: overstory removal, SW: shelterwood, IMP: improvement cutting

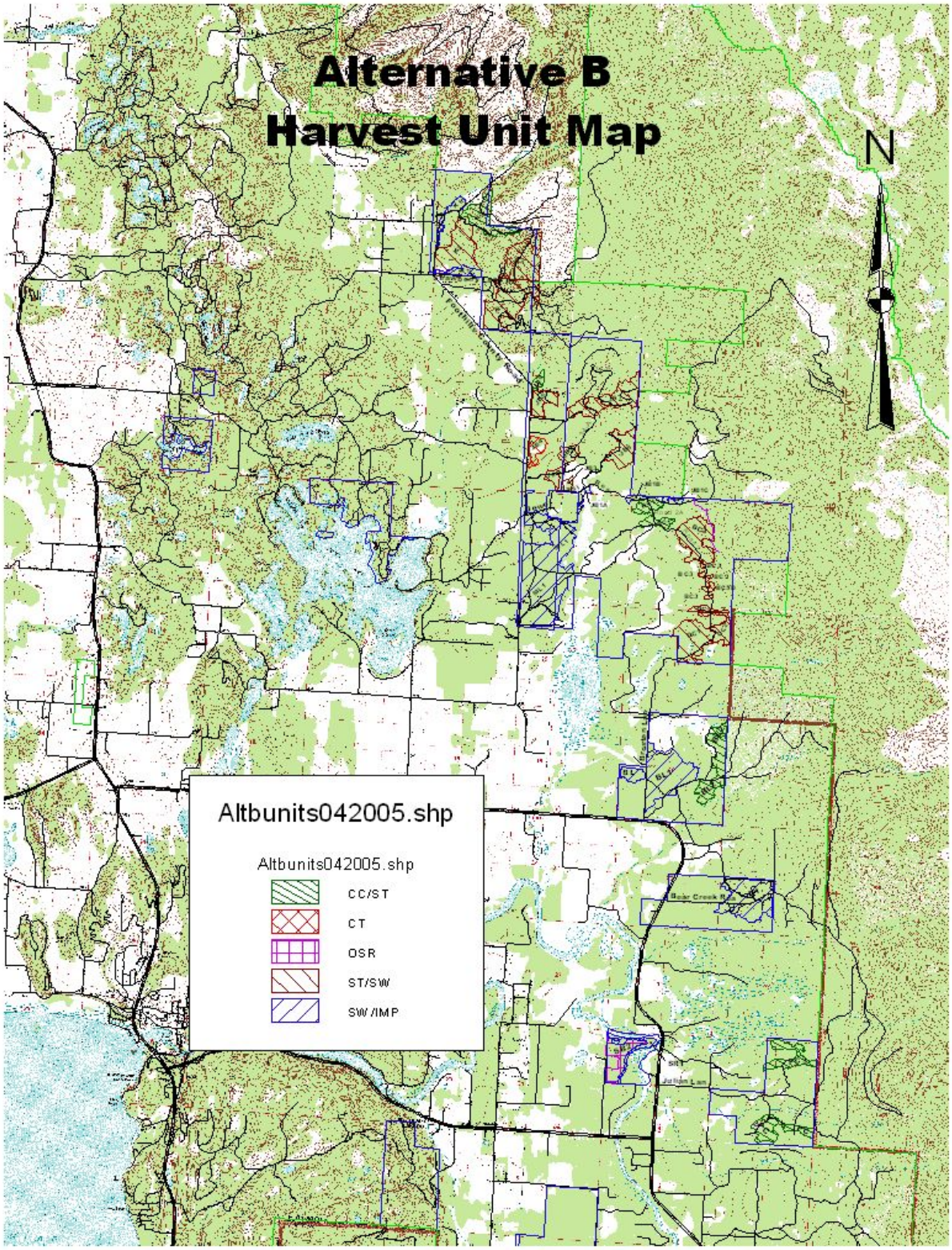
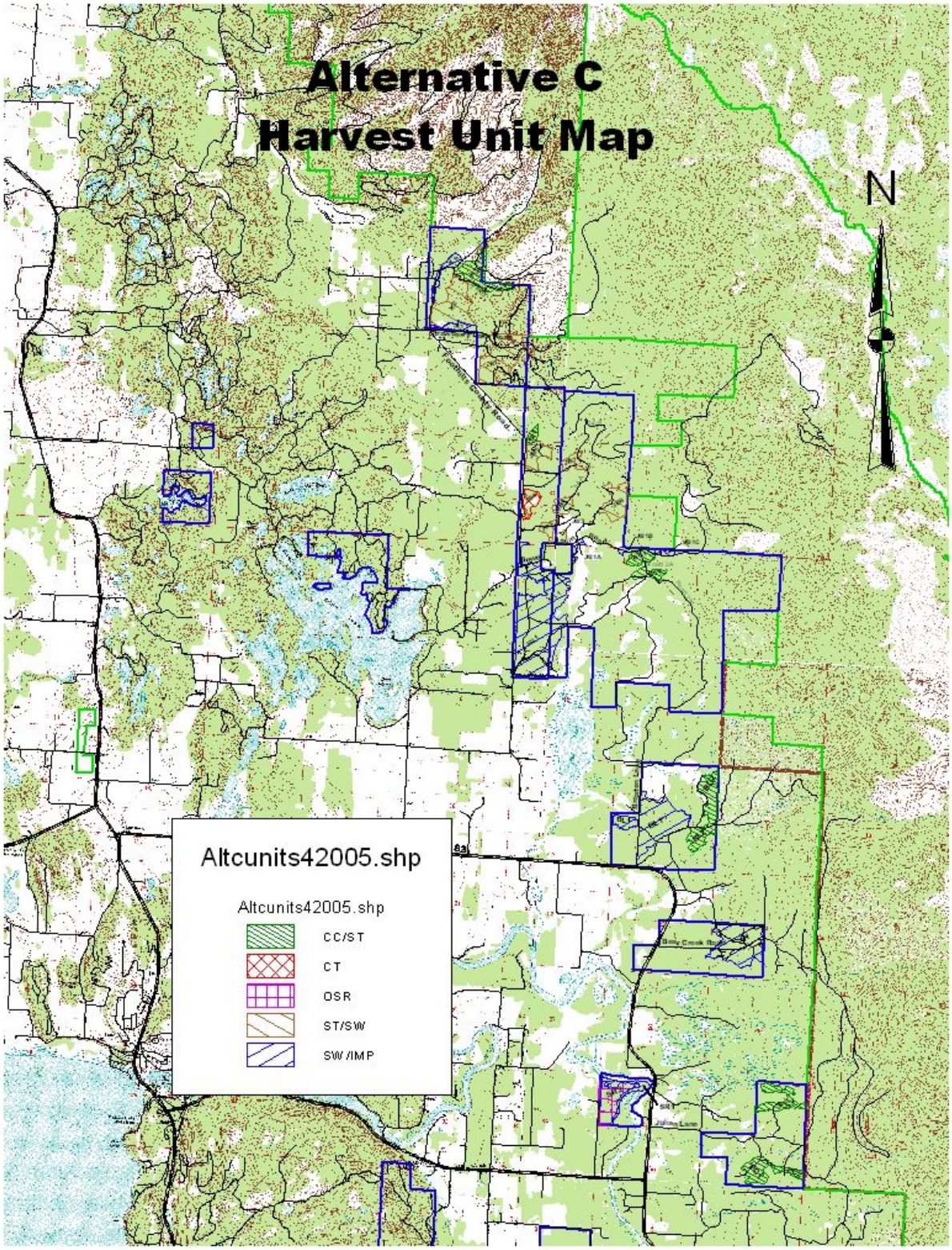


Figure 2-2. Alternative C Harvest Units. Map Abbreviations are CC: clearcut, ST: seedtree, CT: commercial thin, OSR: overstory removal, SW: shelterwood, IMP: improvement cutting



2.4 SUMMARY COMPARISON OF ALTERNATIVES

Each alternative is unique in terms of activities, achievement of project objectives, and effects that would occur. This section presents key characteristics of the alternatives, using tables to display differences and make comparisons.The following table provides a brief comparison of on-the-ground activities that would occur if Alternative A, B, or C were implemented.

Table 2-1: Summary Comparison of Project Activities for Each Alternative

Alternative	MMBF Harvest	Acres Treated	Acres by Harvest Method	Road Management
No Action Alternative A	0 MMBF	0	Regeneration Harvest: 0 acres Intermediate Harvest: 0 acres	Miles new road: 0 Miles open road: ~ 17.6
Action Alternative B: High salvage	~9 MMBF	~1468	Regeneration Harvest: 843 acres Intermediate Harvest: 625 acres	Miles new road: ~1.1 Miles open road: ~7.1
Action Alternative C: Low salvage	~7 MMBF	~1156	Regeneration Harvest: 531 acres Intermediate Harvest: 625 acres	Miles new road: 0 Miles open road: ~7.1

The following table provides a comparison of how each alternative would meet the project objectives identified in Chapter 1.

Table 2-2: Summary Comparison of Achievement of Project Objectives

Objective	Indicators	No Action Alternative A	Action Alternative B: High Salvage	Action Alternative C: Low Salvage
Generate revenue for the School (CS) grants.	Stumpage receipts (dollars)	0	$2,427,040	$1,808,160
Develop a manageable, maintainable road system that provides: a) appropriate access for short and long term management and use of these trust lands, and b) improves surface drainage and stream crossings on existing roads.	Miles of new road	0	1.1	0
	Total miles of road used and upgraded	0	44.5	38.7
	Miles of road closed	0	18.2	17.0
Manage for long-term productivity through silvicultural treatments that: a) promote the retention and/or regeneration of western white pine, western larch, and other seral species appropriate for the sites, and b) increase stand vigor and reduce the amount of insect infested or disease infected trees.	Acres proposed to regenerate	0	843	531
	Acres treated to improve health and vigor	0	625	625

The table (2-3) on the following pages summarizes the environmental effects of each alternative. Additional details of environmental effects can be found in Chapter 4.

Table 2-3: Summary of Environmental Effects

Resource Issue	Direct Effects	Indirect Effects	Cumulative Effects
Vegetation: Age class & Cover Type	**A –** continued annual loss of WWP & GF. Reduction in stand age due to higher rate of mortality in older trees. **B –** Mixed conifer cover type decreases by 1248 acres; western larch/ Douglas fir and western white pine cover types increase by 363 and 885 acres, respectively. 1256 acres less in the 150+ age class. **C -** Mixed conifer cover type decreases by 956 acres; western larch/ Douglas fir and western white pine cover types increase by 273 and 684 acres, respectively. 944 acres less in the 150+ age class.	**A –** regeneration favors shade tolerant tree species with continued over representation of mixed conifer cover types. Acres in 0-39 year age class would continue to decline, and be underrepresented. **B** – 843 acres would be regenerated with desired tree species. Acreage in the underrepresented younger age classes would increase with 27% decrease in 150+ yr. age class. **C-** 531 acres would be regenerated with desired tree species. Acreage in the underrepresented younger age classes would increase with 20% decrease in 150+ yr. age class.	**A –** reduction in WWP cover type would continue in an area that has the greatest opportunity on the Kalispell landscape for supporting WWP. Diversity of age class would decline. **B –** Mixed conifer cover type distribution on the Kalispell Landscape decreases by 2.3%; western larch/Douglas – fir and western white pine increase by .7 and 1.5 % respectively. 150+ age class decreases by 2.2%. **C –** Mixed conifer cover type distribution on the Kalispell Landscape decreases by 1.6%; western larch/Douglas – fir and western white pine increase by .4 and 1.2%. 150+ yr. age class decreases by 1.7%.
Vegetation: Old growth stands	**A/B/C –** no immediate change	**A/B/C -** would continue to develop under natural influences. At risk due to current insect infestation in grand fir.	**A/B/C –** may result in natural, small decrease in old growth stand distribution on the Kalispell Landscape.
Vegetation: Western Hemlock distribution	**A –** western hemolock presence is dependent upon climatic factors. No immediate change. **B/C –** approximately 150 acres with a component of western hemlock would be thinned. Some hemlock trees would be cut and removed.	**A –** no change **B/C –** no change in distribution. Some hemlock regeneration may occur under thinned tree canopy	**A –** no change **B/C –** no change
Vegetation: Stand Structure and Development	**A –**unstable conditions of late successional forests continues to influence stand development maintaining multi-storied and multi-aged structures. **B-** 280 acres treated with clearcut or seed tree cuts resembling a stand replacement fire **C-** 234 acres treated with clearcut or seed tree cuts resembling a stand replacement fire	**A –** fuel build up continues and potential for stand replacement fires increase **B-** single –storied and even aged conditions would occur on an additional 280 acres, decreasing multi –storied conditions to 67% **C-** single –storied and even aged conditions would occur on an additional 234 acres, decreasing multi-storied conditions to 72%	**A –** change dependent on tree mortality rates, or wildfire occurrence **B/C –** acreage on the Kalispell Landscape with single-storied and even aged conditions would increase by 1%
Vegetation: Timber Productivity and Value	**A –** no change **B –** 1468 acres treated, reducing infection source, salvaging dead and dying, and improving individual tree growing conditions of trees less susceptible to current damaging agents. **C –** 1156 acres treated, reducing infection source, salvaging dead and dying, and improving individual tree growing conditions of trees less susceptible to current damaging agents.	**A –** continued decline of timber productivity and continued increase in forest fuel build up. **B** – 843 acres partially or fully regenerated with healthy and/or disease – resistant seedlings. Stocking levels reduced on 625 acres improving tree growth and vigor. **C –** 531 acres partially or fully regenerated with healthy and/or disease – resistant seedlings. Stocking levels reduced on 625 acres improving tree growth and vigor.	**A –** continued decline in tree growth and value in project area. **B –** improved tree growth and/or tree vigor on 1468 acres or 3% of the forested acres within the Kalispell landscape. **C –** improved tree growth and/or tree vigor on 1156 acres or 2% of the forested acres within the Kalispell landscape.

Resource Issue	Direct Effects	Indirect Effects	Cumulative Effects
Vegetation: Sensitive Plants	**A –**no change **B/C -** BL2 gated and use restricted. Threat to mountain moonwort reduced. Logging not proposed near wetland complexes with sensitive plants.	**A –** no change **B/C –** No indirect effects anticipated.	**A –** no change **B/C –**Threat to mountain moonwort reduced.
Vegetation: Noxious Weeds	**A** – continued encroachment or spread from recreational use on closed and open roads. **B –** site disturbance associated with logging 1468 acres and use of 35 miles of road increases the risk and acreage susceptible to weed establishment **C -** site disturbance associated with logging 1156 acres and use of 29 miles of road increases the risk and acreage susceptible to weed establishment	**A –** continued need for weed control treatments **B –** focused control and treatment measures to control existing weed populations and avoid new establishment in 1/3 or more of the project area. **C -** focused control and treatment measures to control existing weed populations and avoid new establishment in 1/4 or more of the project area.	**A –** no change **B –** possible slight reduction in acreage infested with weeds with focused treatment and improved road closure effectiveness **C -** possible slight reduction in acreage infested with weeds with focused treatment and improved road closure effectiveness

	Direct and Indirect Effects	Cumulative Effects
Hydrology: Water Quality	**A –** no change from existing condition **B -** Would reduce the overall sediment contribution to project area streams. Long term reductions in sediment delivery would happen due to installation of BMPs on several existing stream crossings, and replacement of stream crossing structures that are not adequately designed **C -** Alternative C would reduce the overall sediment contribution to project area streams. Reductions in sediment delivery would happen due to installation of BMPs on several existing stream crossings, and replacement of stream crossing structures that are not adequately designed.	**A –** no change from existing condition **B -** Risk of sediment delivery in the proposed project area would be reduced from current levels by an estimated 12.5 tons per year with Alternative B. Cumulative sediment loading to downstream waters would be reduced through implementation of Alternative B. **C -** Risk of sediment delivery in the proposed project area would be reduced from current levels by an estimated 12.5 tons per year with Alternative C. Cumulative sediment loading to downstream waters would be reduced through implementation of Alternative C
Hydrology: Water Yield	**A -** no change from existing condition **B -** Harvest activities proposed within these watersheds would generate annual water yield increases ranging from as little as 0.1% in Wolf Creek, to as much as 3.8% in Rocky Creek. These levels of increase would not be large enough to cause channel instability, and leave each watershed well within its allowable water yield increase. **C-** Harvest activities proposed within these watersheds would generate annual water yield increases ranging from as little as no increase in Deer Creek, to as much as 3.8% in Rocky Creek. These levels of increase would not be large enough to cause channel instability, and leave each watershed well within its allowable water yield increase.	**A -** no change from existing condition **B –** Water yield levels remain well below the allowable water yield increase, and would not be sufficient to cause in-channel adjustments to flows. **C-** Water yield levels remain well below the allowable water yield increase, and would not be sufficient to cause in-channel adjustments to flows.
Soils:	**A –** no change from existing condition **B/C –** No impacts on slope stability. Detrimental soil impacts on 15% or less of proposed harvest area.	**A –** no change from existing condition **B/C** – Cumulative impacts on 20% or less of harvested areas; in most units impacts would be less than 15%.

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Fisheries: Presence and Genetics	**A –** no change from existing condition **B -** As a result of the selection of Alternative B, there is not expected to be any direct or indirect impacts to fisheries presence and genetics in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions. **C -** As a result of the selection of Alternative C, the direct and indirect impacts to fisheries presence and genetics in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.	**A -** no change from existing condition **B -** There is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C –** Cumulative impacts are expected to be the same as those described for Alternative B.
Fisheries: Flow Regimes	**A-** no change from existing condition **B -** The expected 0.1 to 3.8 percent increase in flow regime to basins in the project area could affect native and non-native fisheries. However, the expected slight increases and consequent potential adverse effect is not likely to have a detectable or otherwise measurable impact to native and non-native fisheries in the project area. **C -** The expected 0.1 to 3.8 percent increase in flow regime to basins in the project area could affect native and non-native fisheries. However, the expected slight increases and consequent potential adverse effect is not likely to have a detectable or otherwise measurable impact to native and non-native fisheries in the project area.	**A-** no change from existing condition **B -** There is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C –** Cumulative impacts are expected to be the same as those described for Alternative B.
Fisheries: Sediment and Channel Forms	**A -** no change from existing condition **B -** There is a low risk of sedimentation to lower Rocky Creek, Birch Creek, and Patterson Creek as a result of the road-stream crossing use proposed in Alternative B. The Hydrology Analysis also indicates that road improvements associated with Alternative B would reduce long-term sedimentation from low to moderate grade roads in the project area. With respect to those existing conditions described in Section 3, the selection of Alternative B would have a low risk of direct and indirect impacts to the sediment and channel form components of fisheries habitat in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River. **C -** As a result of the selection of Alternative C, the direct and indirect impacts to the fisheries habitat variables of sediment and channel forms in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.	**A -** no change from existing condition **B -** There is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C –** Cumulative impacts are expected to be the same as those described for Alternative B.

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Fisheries: Riparian Function, Large Woody Debris, and Stream Temperature	**A -** no change from existing condition **B -** There is a low risk of direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in the Swan River beyond those described in the Existing Conditions. There is expected to be a low direct and indirect impact to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Krause Creek. There is a very low risk of measurable or otherwise detectable direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Wolf Creek, of Echo Creek, Noisy Creek, lower Rocky Creek, Bear Creek, Peterson Creek, Birch Creek, and Patterson Creek beyond those described in the Existing Conditions. **C -** The direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.	**A -** no change from existing condition **B -** There is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C –** Cumulative impacts are expected to be the same as those described for Alternative B.
Fisheries: Connectivity	**A -** no change from existing condition **B -** There is not expected to be any direct or indirect impacts to the fisheries habitat variable of connectivity in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C -** There is not expected to be any direct or indirect impacts to the fisheries habitat variable of connectivity in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions.	**A -** no change from existing condition **B -** There is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions. **C –** Cumulative impacts are expected to be the same as those described for Alternative B.
Wildlife: Patch Size and Interior Habitats	**A -** no change from existing condition. Nine patches of semi-closed and closed canopy stands ranging from 10-2,510 acres would be retained. Amounts of Interior (2,472 acres), edge (1,580 acres), and open (835 acres) would remain unchanaged. **B-**. The harvest prescriptions would convert 843 acres of semi-closed and closed canopy forest to forest openings. Ten patches, ranging from 10-2,017 acres, would be produced. Interior forest conditions would be reduced by 912 acres, and edge habitat would increase by 113 acres. This alternative would reduce habitat for species that use semi-closed and closed canopy forests and interior habitat, while increasing habitat for wildlife species that use openings and edge habitats. **C -** The harvest prescriptions would convert 531 acres of semi-closed and closed canopy forest to forest openings. Ten patches, ranging from 10-2,350 acres, would be produced. Interior forest conditions would be reduced by 513 acres, and edge habitat would increase by 20 acres. This alternative would reduce habitat for species that use semi-closed and closed canopy forests and interior habitat, while increasing habitat for wildlife species that use openings and edge habitats.	**A-** no change from existing condition **B-** The effects described in Alternative B would be cumulative to the reductions of semi-closed and closed canopy forested habitats on adjacent private lands. While retention areas along USFS lands would continue to provide semi-closed and closed canopy forested habitat patches. **C -** The effects described in Alternative C would be less than Alternative B

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Wildlife: Connectivity	**A -** no change from existing condition **B -** Connectivity through the project area is expected to be retained, albeit reduced. **C -** Connectivity through the project area is expected to be retained, albeit reduced. The effects of this alternative are expected to be less than under Action Alternative B due to the reduced harvest acreage.	**A -** no change from existing condition **B and C -** Connectivity through the project area could be altered by the proposed harvests. However, connectivity appears to be retained along the major stream courses and in unharvested uplands. Continued habitat modification on adjacent private lands could inhibit connectivity from the project area to areas lower on the valley floor. However, connectivity from USFS lands into and through the project area appears to be retained under these alternatives.
Wildlife: Dead Wood Resources	**A -** Through time, quality nesting structure and available cavities are expected to decline, while poorer quality nesting structure would remain constant or increase. Additionally, foraging structure is expected to increase. Cavity nesting birds are expected to continue to use the area, but reproduction and populations could be reduced due to lower quality nesting snags present on these sites. **B -** Snag habitat, primarily smaller, shade-tolerant species, would be reduced on 1,468 acres. Species associated with snag habitat within open canopy forested conditions are expected to increase, but to a lesser extent than if a full complement of historic snag densities were retained. **C -** The effects discussed under Action Alternative B would be expected under this alternative, but to a lesser degree due to the reduced harvest area.	**A -** Cumulative dead wood habitat is expected to follow the trend discussed in the direct and indirect effects on managed lands with decreases in habitat on developed lands. Motorized access would continue to contribute to the loss of dead wood. **B –** This alternative would reduce dead wood habitat, which would be cumulative to loses on adjacent private lands. In the long-term, shade-intolerant species would increase to provide higher quality snag habitat. The trends discussed under the No Action Alternative are expected to occur on the adjacent National Forest Service Lands. Restricted motorized access is expected to reduce snag loss. **C -** The cumulative effects are expected to be the same as those described under Action Alternative B, except that the scope of the effects would be reduced due to the reduction in acres harvested and road miles.
Wildlife: Bald Eagle	**A -** no change from existing condition **B and C –** Six hundred sixty-six acres of habitat within 2 bald eagle territories would be affected. These alternatives are expected to result in minor positive effects to bald eagles due to increased access to winter-killed big game and increased security resulting from road restrictions.	**A -** Continued illegal motorized access and firewood cutting would continue, thereby accelerating the decrease in bald eagle perching structure. **B and C -** If the planned road closures were successful, additional loss of retention trees would be minor and only be possible near open roads. Development on adjacent lands is expected to decrease habitat structure and increase human disturbance, which could adversely foraging eagles. Cumulatively, the proposed harvest units are not likely to adversely affect eagle use or reproductive success of either territory.

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Wildlife: Grizzly Bear	**A -** The current level of motorized disturbance (legal and illegal) would continue to reduce grizzly bear security and increase displacement, resulting in increased mortality risk and energetic costs of bears using the project area. **B -** The planned transportation plan would reduce open road density from 3.6 to 3.1 miles/sq. mile. Motorized disturbance is expected to decrease due to reinforcement of road closure devises. The increase in forage production is expected to result in minor positive effects to grizzly bears. The loss of hiding cover and visual screening due to timber harvests could result in increased mortality or energetic costs of bears using the area. The effects associated with the removal of hiding cover and visual screening within the harvest units are expected to last approximately 6-10 years and could be offset largely by the proposed access management plan. **C** - Overall, the effects discussed under Alternative B would be expected to occur under this alternative, also. The effects expected due to access management are the same as Alternative B. The effects expected due to the loss of hiding cover and visual screening are expected to be less than Alternative B due to the reduced area of harvest and could be offset largely by the proposed access management plan.	**A -** The current level of hiding cover and motorized disturbance (legal and illegal) would continue. Habitat security on adjacent lands is low. **B and C** - In the short-term, the proposed project could increase mortality risk in the subunit due to increased visibility, however, reduced motorized access would reduce this risk. In the longer term, grizzly bears would benefit by the increased security, reduced disturbance, and to a lesser extent, forage production.
Wildlife: Fisher	**A -** No changes in fisher habitat are expected (4,052 acres). The continued illegal access and firewood cutting would continue to remove important fisher habitat structure. **B -** Under this alternative, 1,186 acres of fisher habitat would be converted to unsuitable, while 280 acres of habitat would be modified. Fisher resting and denning structure is expected to decline, resulting in decreased fisher habitat in all units, but allowing travel through the 280 acres of units modified by timber harvests. Harvests within 100' of class 1 streams and within 50' of class 2 streams would likely retain greater than 40% canopy cover after harvest, thereby retaining the existing 89.6% of moderate to well stocked sawtimber stands associated with these streams. **C -** Under this alternative, 879 acres of habitat would be rendered unsuitable, while 276 acres would be modified. Fisher resting and denning structure is expected to decline, resulting in decreased fisher habitat in all units, but allowing travel through the 276 acres of units modified by timber harvests. Harvests within 100' of class 1 streams and within 50' of class 2 streams would likely retain greater than 40% canopy cover after harvest, thereby retaining the existing 89.6% of moderate to well stocked sawtimber stands associated with these streams.	**A -** No near term changes in fisher habitat are expected. Continued illegal motorized access and firewood cutting would continue to decrease in fisher resting/nesting structure. Shade-tolerant cover types would be perpetuated on public lands. **B and C-** All alternatives would result in retaining >40% canopy cover along streams, which fishers are expected to use for travel through the project area and provide connectivity between USFS lands and private lands in the valley bottom, although habitat in the valley bottom is expected to be limited. Firewood cutting would continue to remove important resting/nesting structure. If the road access management plan were effective, additional losses of structure away from open roads would be minimal. However, if the road access is not successful, the vulnerability of these large trees/snags would increase, resulting in further decreasing fisher habitat structure. Habitat on USFS lands is expected to be retained.

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Wildlife: Pileated Woodpecker	**A -** No changes in the amount or distribution of pileated woodpecker habitat are expected. Continued illegal access and associated firewood cutting would continue to remove important nesting structure. Over time, shade-intolerant tree species that provide important nesting structure would continue to decline and become more rare in the project area. **B -** This alternative would reduce pileated nesting habitat by 833 acres, leaving approximately 1,585 acres (65.6%). **C -** This alternative would reduce pileated nesting habitat by 709 acres, leaving approximately 1,709 acres (70.7%).	**A -** Continued illegal motorized access and firewood cutting would continue to decrease in pileated nesting structure. Through time, shade-intolerant nest sites are expected to decrease due to forest succession. **B and C -** Continued illegal motorized access and firewood cutting would likely continue, thereby decreasing pileated nesting structure. Nesting and foraging habitat is expected to be retained on USFS lands surrounding the project area, while habitat on private lands in the area is expected to decline due to removal of large trees and snags.
Wildlife: Big Game Species	**A -** no change from existing condition **B -** Under this alternative, 854 acres of thermal cover would be removed and 554 acres would be reduced to "semi-closed canopy cover" as defined, resulting in approximately 57% of the project comprised of thermal cover with an additional 13% of snow intercept cover. The remaining 30% is in openings that provide forage, but offer little thermal protection. The effects related to the loss of hiding cover is expected to last until the harvest units regenerate enough vegetation to once again provide hiding cover (6-10 years). Controlling motorized access could offset the increased vulnerability of big game due to the loss of hiding cover. Reductions in open road density are expected to decrease big game disturbance. This alternative would reduce open road densities from 3.6 to 3.1 miles/sq. mile, while attempting to reduce illegal use by reinforcing existing closures. **C -** Under this alternative, 531 acres of thermal cover would be removed and 554 acres would be reduced to "semi-closed canopy forest," as defined resulting in approximately 63% of the project comprised of thermal cover with an additional 13% of snow intercept cover. The remaining 24% is in openings that provide forage, but offer little thermal protection. The reduction in thermal and snow intercept cover is expected to result in minor changes in big game habitat use, but not to effect carry capacity.	**A -** no change from existing condition **B and C -** These alternatives are not expected to alter the carrying capacity of this winter range. The proposed motorized restrictions are not expected to reduce hunter access to the project or surrounding area.
Air Quality:	**A -** no change from existing condition **B & C -** Alternative B and Alternative C would temporarily increase the amount of smoke and dust produced in the project area, Alternative B's increase would be slightly higher in the north half of the project area. The increased dust and smoke emissions are not expected to exceed air quality standards, and would be temporary, localized reductions to air quality such as currently occurs.	**A -** no change from existing condition **B & C -** Cumulative effects during peak burning periods may affect nearby residents for short durations. Project related traffic during dry periods in addition to current road users may affect nearby residents for short durations, as well.
Aesthetics:	**A -** In the short term, there would be little change to the current views of the project area. Small trees and shrubs would continue to grow and tend to limit views from open roads. No indirect effects to aesthetics were determined as a result of the No Action Alternative.	**A -** No other major projects are planned within the project area in the next 5 years. Some stands may be pre-commercially thinned which would open up the stands and increase sight distance. Any salvage operations would have little effect on aesthetics.

Resource Issue	Direct and Indirect Effects	Cumulative Effects
Aesthetics (continued)	**B -** This alternative would harvest approximately 1468 acres and change the current view on these acres. Regeneration harvests would occur on 843 acres. Views would be very open with the majority of the overstory being removed. 625 acres would have intermediate harvest and have a more mosaic overstory. Views would be more open than current views. **C -** This alternative would harvest approximately 1156 acres and change the current view on these acres. Regeneration harvests would occur on 531 acres. Views would be very open with the majority of the overstory being removed. 625 acres would have intermediate harvest and have a more mosaic overstory. Views would be more open than current views.	**B & C -** Natural disturbances such as wildfires, blowdown, insect and disease outbreaks could occur over time and change the view of the project area. Any subsequent salvage operations would alter the view by removing dead and dying trees, damaging some residual vegetation, and causing some ground disturbance. Ongoing activities such as firewood gathering and recreation would alter some views on a very small scale.
Recreational Use:	**A -** Amount of use would continue at the same level or slightly increase as the population in close proximity to the project area grows. Revenue may increase from this use, but is expected to be slight. **B -** Recreational use in the Foothills Timber Sale project area may change, especially during periods of active timber harvesting. Lower levels of use may occur as recreational users choose to avoid logging activities. Project related road construction, improvements, and restrictions would reduce the amount of connecting roads and trails in the project area with the addition of road closure devices and by incorporating slash in road and skid trail prisms not scheduled for long term or continual access. Disruption or displacement of recreational use may be endured for longer periods or would effect a larger portion of the project area than under Alternative C. The restricted 34A road under this alternative would provide 2 more miles of road for traditional non-motorized use than Alternative C. **C -** Silvicultural treatments would be applied to 24% of the Foothills project area under Alternative C, and requires approximately 8 less miles of road management work associated with project implementation than Alternative B. Disruption or displacement of recreational use may be endured for shorter periods or would effect a smaller portion of the project area than under Alternative B.	**A -** Amount of use would continue at the same level or slightly increase as the population in close proximity to the project area grows. Revenue may increase from this use, but is expected to be slight. **B & C -** Implementation of the action alternatives may result in increased levels of recreational use on adjacent USFS lands in the Jewel Basin Hiking Area and motorized trails in the Peters Ridge area. This displacement of users is not expected to diminish current levels of trust revenue from recreational use fees, and may result in an increase in the long term.

Resource Issue	Direct Effects	Indirect Effects	Cumulative Effects
Economics:	**A -** None of the estimated revenue for trust beneficiaries or local employment benefits would be realized. **B –** The School Trust income from a sale under Alternative B is estimated to be $1,235,730 enough to fund the education of 175 students for 1 year based on an average cost of $7,080 as determined by information provided by the Montana Office of Public Instruction. **C -** The School Trust income from a sale under Alternative C is estimated to be $922,520 enough to fund the education of 130 students for 1 year based on an average cost of $7,080 per Student per year as determined from information provided by the Montana Office of Public Instruction.	**A -** None of the estimated revenue for trust beneficiaries or local employment benefits would be realized. **B & C -** Income tax collections from the wages of mill workers alone are estimated to generate between $115,000 and $152,000 in state tax revenue, depending on which alternative is selected. Taxes on indirect wages would add to this tax amount. If no other trees were available for harvest after these sale(s), the tendency would be to return to a lower level of economic activity. A short-term impact that might occur as the local economy contracts might be an increase in unemployment as local employers adjust to the lowered production levels.	**A -** If timber from this project is not sold this volume could come from sales elsewhere, however, the timber may be from other areas and not benefit this region of the state. Long-term deferral of harvest from this forest will impact harvest patterns, changing both the region in which the trees are harvested and the volumes taken. This will impact other areas of the state where these changes occur. **B & C -** This sale will be part of the annual harvest of timber from the State of Montana Forest Trust Lands. The net revenue from this sale will add to the trust fund.

CHAPTER 3: EXISTING ENVIRONMENT

INTRODUCTION

This chapter identifies and describes those resources that may be affected by the proposed action, and is organized by general resource categories and their associated issues introduced in Chapter 1. It does not describe any effects of the alternatives, as those will be covered in Chapter 4. The descriptions of the existing environment found in this chapter can be used as a baseline for the comparisons is Chapter 4.

GENERAL DESCRIPTION OF THE AREA

The proposed Foothills Timber Sale Project area is located approximately five miles northeast of Bigfork, Montana and includes approximately 4800 acres of State Trust Lands. The project area is within Sections 21, 28, 27, and 34, T28N, R19W and Sections 1, 2, 3, 10, 11, 14, 23, 24, 35, and 36, T27N, R19W. State Trust Lands within the project area share property boundaries of approximately 5.5 miles with United States Forest Service (USFS) and 20 miles with private landowners. (See Figure 1, Foothills Timber Sale Vicinity Map in Chapter 1). Several other analysis areas were delineated to assess direct, indirect and cumulative effects of the alternatives considered. More specific details about these are contained under each corresponding resource heading.

3.1 VEGETATION

The vegetation section describes present conditions or components of the forest in order to address the potential effects of proposed alternatives in Chapter 4. Issues expressed during initial scoping by the public and internally are:

- Timber harvesting and associated activities may affect forest stand characteristics and in regards to forest composition, age, and succession.
- Timber harvesting and associated activities may affect the distribution and amount of old growth stands.
- Timber harvesting and associated activities may affect the distribution and amount of western hemlock stands.
- Timber harvesting and associated activities may affect stand structure and development.
- Insects and disease may affect timber productivity and value.
- Timber harvesting and associated activities may affect the distribution and vigor of sensitive plants.
- Timber harvesting and associated activities may increase noxious weeds in the project area.

These issues can be evaluated by analyzing the anticipated changes in current forest conditions in the project area, in conjunction with the extent and location of silvicultural treatments.

Analysis Methods

Administrative Rules of Montana (ARM 36.11.404) direct DNRC to take a coarse filter approach to favor an appropriate mix of stand structures and compositions on state lands, referred to as a desired future condition. The following characteristics: forest composition, age class distribution, cover type and structure, are used to describe current forest and stand conditions in comparison to the estimated natural forest characteristics for Montana prior to extensive influences from fire suppression, logging, and development. This analysis will compare the desired stand conditions that DNRC believes to be appropriate for the site with current stand conditions.

Forest/Timber Analysis Methods: The DNRC site–specific model (ARM 36.11.405), was used to determine the characteristics of the desired future condition and to evaluate the potential direct, indirect, and cumulative effects. This model compares the 1930's forest inventory data used in *Losenky's* 1993 analysis and subsequent 1997 report of estimated proportions of forest stand structural stages by cover type historically represented throughout Montana, to the 2004 DNRC Stand Level Inventory database that estimates current forest conditions. More recent field observations and tree data were gathered to further

refine specific forest stand characteristics within the project area. This data is available at the Kalispell Unit. The method used to analyze current and appropriate (desired future conditions) stand conditions, old growth timber stands, and stand development follows:

- *Current & Appropriate Conditions:* Two filters were developed for the Kalispell Unit Landscape and applied to 04KalSLI version. This version is the most current stand level inventory, with data updated in 2004. The filters were assigned cover types similar to those used in the 1930's inventory. The first filter followed the 1930's criteria exactly, or as closely as possible, representing current conditions. The second filter represents the department's desired future conditions (DFC) as defined in ARM 36.11.404 and 405. The second filter for appropriate conditions assigns cover types using criteria primarily designed to help address the situation where succession from one cover type to another is occurring. This successional filter was developed to indicate that those areas in the absence of fire suppression, introduced pathogens, and timber harvesting would likely have been assigned to a different cover type than the current cover type filter would suggest. The appropriate filter estimates, from the current stand conditions, what cover type representation might have looked like in 1900.
- *Old Growth Timber Stands:* the methods to identify old growth timber stands, as defined by ARM 36.11.403 (48), are based on the Kalispell SLI data. The process uses the SLI to identify stands that may meet the minimum criteria (number of trees per acre that have a minimum dbh and minimum age) for a given habitat type group as described in Green et al, *Old Growth Forest Types of the Northern Region* (1992). Field surveys were used to verify that the definition is met in the identified stands and to determine if additional stands meet the definition.
- *Stand Structure/Development:* the analysis on stand structure and development is qualitative, and discusses the conditions of timber stands, including how various natural and man-caused disturbances and site factors have affected and may continue to affect timber stand development.

Sensitive Plant Analysis Methods: The Montana Natural Heritage Program (MTNHP) database was consulted by DNRC for information regarding occurrence of plant species of special concern and the potential for sensitive plants and their habitats within the project area. In 1998, DNRC contracted with botanist Shannon Kimball to perform a field survey of the project area to determine presence, locations and mitigation measures for sensitive plants within the project area. Following recommendations in the 1998 survey report, DNRC contracted with botanists John Pierce and Drake Barton to perform a follow up survey of the project area in the spring of 2001. The *Kimball (1998)* and *Pierce, Barton (2001)* reports of survey results are available at the Kalispell Unit as part of the Foothills project file.

Noxious Weed Analysis Methods: During field reconnaissance, DNRC personnel assessed road conditions, road locations, various susceptible timber stands, stream conditions, and generally evaluated noxious weed occurrence, extent and location.

Analysis Area

Forest/Timber Analysis Area: this analysis area includes 3 geographic scales for assessing potential direct, indirect and cumulative effects on forest cover type, species composition, the distribution of age classes, structural stages, and fragmentation.

- Climatic Section M333B - **Lower Flathead Valley (*Losensky, 1997*) Scale** was used in this analysis for comparing historic conditions related to the distribution of forest cover types and age classes, to current conditions within the project area. The Lower Flathead Valley geographic area includes Flathead Lake west to the Montana border, from the Canadian border south to Missoula, MT (*Losensky, 1997)*.

- The **DNRC Kalispell Landscape Scale** includes all scattered forested trust land parcels, administered by the Kalispell Unit for DNRC. This geographic area is a subset of the above Lower Flathead Valley Climatic Section and includes school trust lands in the vicinity of Whitefish, MT

south to Arlee, MT and school trust lands in the vicinity of Bigfork, MT west to the Thompson Chain of Lakes. Current and appropriate conditions related to forest cover types, and age class distribution were analyzed on this scale.

- The **Foothills Project Level Scale** includes all trust lands within the project area specified in Chapter 1 and more specifically those stands proposed for harvesting under each alternative. This scale was used to analyze expected changes in current forest conditions of the project area.

Sensitive Plants/Noxious Weeds Analysis Area: The analysis area for noxious weeds and sensitive plants species, are trust lands within the project area. Surveys identifying sensitive plant occurrences were compared to proposed harvest sites and road construction locations for assessing direct and indirect effects, and developing mitigation measures, if needed.

General Forest Vegetation Information

The existing vegetative types, more specifically forest habitat types and cover types within the Kalispell Landscape and the Foothills project area, reflect the varied influences of site factors, fire regimes or disturbance patterns, and past management activities.

Site conditions vary depending upon the physiographic and climatic factors associated with geographic locations. Soil types, slope aspect and position, length of growing season, and moisture availability influence the type, growth and development of forest vegetation. These site factors are considered in the forest habitat classifications (*Pfister, et al, 1977*), used to generally describe forest vegetation, forest stand development, and relative forest productivity associated with the given site and climatic factors.

Most of the Foothills project area occurs on glacial till derived soils. Soils are generally silty or loamy with coarse rock fragments or cobbles. Slopes are gentle to moderate, rarely exceeding 40%, and aspects that are not flat are generally westerly. (Refer to soils section for more detail.)

Stand History/Past Management

Foothills Project Area: In the 1930's over 900 acres within the project area were recovering from disturbances associated with wildfires or windstorms. Much of the burnt acreage incurred stand replacement fires. Between 1930 and 1960, most parcels except Section 1 had been heavily harvested. In the 1960's another wind event resulted in extensive blowdown in the project area and a subsequent salvage harvest. The latest harvests occurred in the 1980's treating approximately 530 acres with regeneration harvests. In the last 2 decades forest management activities have been limited to minor amounts of planting, precommercial thinning, weed spraying, and incidental cutting of Christmas trees, firewood, or post and rails. Active fire suppression starting in the 1930's has limited the extent of wildfires to small acreages, generally less than ¼ acre in size.

Adjacent Lands to Foothills Project Area: This project area is immediately adjacent to mostly privately owned valley bottomlands to the west. Until the late 1980's or mid 1990's these lands were traditionally larger, agricultural tracts. Grains, hay, pasture, and Christmas tree farms occupied most of the cleared acreages with strips or patches of mature to immature forest of similar composition to the Foothills Project Area. Starting in the late 1980's parcel size has decreased, as tracts have been sold for residential use. Most of the Christmas tree farms have been converted to fields or yards and numerous forest patches have been thinned, salvaged, or converted to wooded home sites.

Flathead National Forest lands comprise the majority of lands to the east of the project area. Mature forests of the mixed conifer (MC) cover type or the subalpine (SAF) cover type occupy approximately 60% of lands immediately adjacent to the project area. Immature forest less than 40 years old occupy the remaining portion, resulting from large clearcuts resembling stand replacement fires, or recovering wildfire or avalanche disturbed areas.

Forest Habitat Types

In the Foothills project area, approximately 90% of the area is occupied by forest habitat types in the grand fir (*Abies grandis)* series and western hemlock (*Tsuga heterophylla*) series, indicating the influence of warm and moist climatic conditions. The occurrence of the low elevation, mesic forest covering these

forest habitat series, in Northwest Montana, is dependent upon the eastward penetration of moist Pacific air masses (Habeck, 1968). Grand fir*,* western white pine *(Pinus monticola*)*,* western red cedar (*Thuja plicata*)*,* and western hemlock are often conspicuous components these coniferous forests (Antos and Habeck, 1981), that are classified in the forest habitat types above. The distribution of these tree species becomes more discontinuous, as they reach their range limits near the continental divide (Daubenmire, 1975), as is the case for the Foothills area. While Glacier Park has stands more often dominated by cedar or western hemlock, these species diminish southward with mostly grand fir dominated stands common in the north Swan Valley (Antos and Habeck, 1981). The Foothills project area lies between Glacier Park and the north Swan Valley, with climatic conditions supporting both forest habitat types.

These habitat types are often occupied with a mixture of species. Major species in the Foothills stands include grand fir or western hemlock. Less predominant species include Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), ponderosa pine (*Pinus ponderosa*), engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*). Timber productivity ranges from moderate to very high for these habitat types, with higher productivity generally found in stands dominated by seral species. Partial cutting practices often lead to dominance by grand fir, whereas even-aged management is more favorable for seral species (Pfister et al., 1977).

Fire Regimes

Habitat types have also been grouped to indicate the severity and frequency of wildfires that historically may have occurred on a site (Fischer & Bradley, 1987*).*

Fire regimes for the Kalispell Landscape are variable, given the broad and scattered nature of trust lands, but are predominantly within the moderate severity fire regime. As a whole, the forest exists as a mosaic of differing age and size classes that have developed from different human activities, fire frequencies and intensities in relation to other site factors such as aspect, elevation, weather, stand structure, and fuel loadings. Areas of frequent fire have produced WL/DF, PP, and DF cover types. In low severity fire regimes, fires occur frequently and create relatively smaller patches of open-grown forest. Historically, these low severity regimes maintained relatively fire-resistant stand conditions, by regularly consuming forest fuels, killing small trees, and pruning boles of small trees (*Agee, 1998*). As fire intervals become longer, more shade tolerant tree species begin to develop in the understory and stands tend to be multi-storied, with varied patch sizes. A mosaic of even and multi-aged patches is present in the project area. These characteristics reflect the moderate severity fire regime. High severity fire regimes are characterized by large patch sizes and stand replacement fires, but often include low severity fires that act as a thinning agent, or create small openings where clumps of trees die where small crown fires erupt.

The majority of the Foothills project area and all the proposed harvest units are in Fire Group 11 *(Fischer & Bradley, 1987)*. This fire group represents moist grand fir, western hemlock, or western red cedar habitat types and only occurs west of the Continental Divide in Montana, in locations influenced by maritime climate (*Arno, 1980)*. Fire intervals are considered to be infrequent, 50 –200 years and vary from low severity to high severity. Most of the project area has evidence of past fire activity, and as stated earlier approximately 900 acres had forest stands initiated from stand replacement fires prior to 1930. Forest stands initiated with infrequent stand replacement fires typically have some representation of seral species in the overstory, but most stands have progressed long enough without disturbance that understories are sparse or have thickets of sapling to small sawlog sized trees of predominantly grand fir or Douglas- fir. Harvest units proposed for clear cutting or seed tree cutting comprise stands with few, if any seral species in the overstories. Improvement cuts or shelterwood cuts are proposed for stands that are younger or multi-aged and have a more diverse species mix.

As a result of fire suppression, more characteristic open-grown stands of the DF,WL/DF, or PP cover types now have thick understories of more shade tolerant species, for both the project area and Kalispell Landscape. In general fire frequencies have been lengthened, increased in intensity due to increased fuel loadings vertically and horizontally, and reduced in scale. Large scale, stand replacement fires are part of the historic fire regime for western hemlock and grand fir habitat types grouped in Fire Group 11. Fire exclusion in these high severity fire regimes has had the least effects compared to the effects in lower severity fire regimes (*Agee, 1998)*. Some fires escape suppression efforts especially under droughty, summer conditions that have been experienced over the last several years, although the extent or number of occurrences has likely been altered by aggressive fire suppression.

3.1.1 Forest Age Class & Cover Type Distribution

The following table compares the DNRC Kalispell Landscape (current cover types) with historical data (appropriate cover types) from Losensky (1997) for the Lower Flathead Valley section, as an assessment of desired future conditions regarding cover types. Table 3-1 displays this information.

Table 3-1: Current and Appropriate Cover Types for the Kalispell Unit

Cover Type	Current Cover Type (Acres)	Appropriate Cover Type (Acres)	Current Type Minus (-) Appropriate Type (Acres)
SAF	2249.9	254.8	1995.1
DF	1646.5	1029.4	617.1
HW	449	207	242
LP	2269.2	1376.8	892.4
MC	10265.8	2282.3	7983.3
PP	10636.9	11936.2	-1299.3
OTHER	3635.4	3576.2	59.2
WL/DF	25494.6	32974.5	-7479.9
WWP	567.6	3577.7	-3010.1
TOTAL	57214.9	57214.9	--

SAF = Subalpine fir. DF = Douglas-fir. LP = Lodgepole pine. MC = Mixed conifer. PP = Ponderosa pine. WL/DF = Western larch/ Douglas-fir. WWP = Western white pine. Other = non stocked lands, nonforest, or water. The Current Type minus Appropriate Type column above lists the excess and deficit (-) acres for each Cover Type.

The PP, WL/DF, and WWP (cells shaded in table) cover types are not as well represented within the Kalispell Landscape as estimated for the early 1900's. Most notable, is the conversion of over 11,000 acres in the WL/DF, PP, and WWP cover types, over the last 100 years, to the present over abundance of the MC and SAF cover types by approximately 10,000 acres.

This cover type shift is not atypical for Northwest Montana, but it does represent a change in stand conditions. Active fire suppression initiated in the early 1900's has interrupted wildfire frequencies and intensities in conjunction with 50 years or more of logging practices that favored the removal of commercially valuable western larch (*Larix occidentalis)*, ponderosa pine (*Pinus ponderosa)*, western white pine (*Pinus monticola)* and Douglas-fir (*Pseudotsuga menziesii)* for railroad ties, mining timbers, and construction lumber. Many open, mature stands dominated by western larch and other seral species with even-aged patches of immature seral trees in the understory have been replaced with more densely stocked stands in both the overstory and understory. These stands often include a higher percentage of more shade tolerant trees such as, western hemlock (*Tsuga heterophylla*) or grand fir (*Abies grandis*), spruce (*Picea spp*.) and Douglas-fir, as a result of longer intervals between disturbances.

While longer intervals between disturbances and commodity extraction generally explain the decrease in the WL/DF and PP cover types, it only partly explains the decrease in the WWP cover type. This cover type distribution has been greatly affected by the western white pine blister rust across the Pacific Northwest for several decades. The number of healthy white pines occupying upper canopy levels has been declining as a result of the rust, and therefore affects the cover type classification.

The following table makes the same comparison for determining desired future conditions for the Foothills project area.

Table 3-2: Current and Appropriate Cover Types for the Foothills Project Area

Cover Type	Current Cover Type (Acres)	Appropriate Cover Type (Acres)	Current Type Minus (-) Appropriate Type (Acres)
SAF	0	0	0
DF	40.5	39	1.5
HW	284.4	34.7	249.7
LP	252	49.8	202.2
MC	3526.4	1087.3	2439.1
PP	145	173.7	-28.7
OTHER	82.6	82.6	0
WL/DF	201.8	714.8	-513
WWP	283.3	2634.1	-2350.8
TOTAL	4816	4816	--

SAF = subalpine fir. DF = Douglas-fir. LP = Lodgepole pine. MC = Mixed conifer. PP = Ponderosa pine. WL/DF = Western larch/ Douglas-fir. WWP = Western white pine. Other = non stocked lands or nonforest. The Current Type minus Appropriate Type column above lists the excess and deficit (-) acres for each Cover Type.

The Foothills project area reflects the same trend in forest cover type shifts as the Kalispell landscape, notably that WWP, WL/DF, and PP cover types represent a smaller proportion of the cover types, and MC represents a much larger proportion, than likely occurred in the early 1900's. For the Foothills project area the large deficit representation of the WWP cover type is due mostly to the affects of white pine blister rust. Other minor factors include the further loss of mature trees to pine beetles, mechanical damage to seedlings and saplings from Christmas tree cutting, firewood cutting activities, and some recreational activities, and favoring the removal of this species in previous timber harvests.

A further depiction of the shift in species composition associated with the change in forest cover types for the Foothills Project Area is shown below in Table 3-3. The state inventory prepared for classified forest lands in the 1920's to 1930's includes records for most of the Foothills Project Area, and indicates a predominance of white pine, and western larch or Douglas-fir as it regards the % of tree species by merchantable volume.

Table 3-3: Foothills Project Area: Percentage of tree species composition by volume from 1930's and 1980's inventory estimates.

Tree species[1]	WP	WL/DF	WF	LP/S	PP
1930's	44	50	4	1	1
1980's	TRACE	9	73	9	5

[1] WP = western white pine; WL/DF = western larch and/or Douglas-fir; WF= white fir(grand,subalpine, hemlock); LP/S = lodgepole pine or spruce; PP = ponderosa pine

Age class distributions in conjunction with other forest stand conditions or characteristics are useful in determining general historic conditions for inferring desired future conditions. Table 3-4 displays Age Class Distribution on project area and landscape scales. Stands in the seedling-sapling age class are under-represented compared to the historical condition for both the Kalispell landscape and the project area, and the 40 to 150 age classes over represented. This deviation from historical conditions can partially be explained by successful fire suppression increasing the interval between large, stand replacement fires and logging practices that did not necessarily create a similar disturbance to a wildfire.

Table 3-4: Historic and Current Age Class Distribution

Percent of Analysis Areas by Age Class Groups (years):				
Analysis Area	00 - 39	40- 99	100 - 149	150+
M33B (historic)	36	13	15	36
Kalispell (current)	10	21	30	39
Foothills (current)	11	5	15	69

3.1.2 Distribution of Old Growth Stands

As per the State Land Board's decision in February, 2001, the DNRC adopted definitions for old growth by forest habitat groups, based on minimum number and size of large trees per acre and age of those trees as noted in *Old-Growth Forest Types Of The Northern Region*. The DNRC approach to old growth management (and forest management in general) is further clarified in (ARM 36.11.401 to 36.11.450). Field verification of older stands modeled in the coarse filter analysis of SLI data for the project area identified only one stand meeting the DNRC's old growth definition.

This stand is 22 acres, occurs in Section 36, T27N, R19W, and exhibits high quality "old growth" characteristics. It is dominated by grand fir and is currently being threatened by the fir engraver (*Scolytis*), which is responsible for a large percentage of mortality occurring in grand fir stands throughout the Flathead Valley, as well as the project area. In spite of the stand acreage in the project area estimated to be 150 years old or more, the stocking level of large diameter trees per acre in these other older stands was insufficient for meeting the minimum old growth definition criteria, except for the stand mentioned.

3.1.3 Distribution of Western Hemlock Stands

The MC cover type includes those stands that have only a small presence, if any, of seral species, such as western white pine, that define other cover types as described in (ARM 36.11.405). These stands are generally stocked with predominantly shade tolerant species and are often in the later successional stages. Since the presence of western hemlock is dependent upon the maritime climate influence, the distribution of this species is limited (historically and currently) on the Kalispell Landscape to its ecological range, occurring on 8% of the area currently assigned the MC cover type. For the Foothills project area grand fir is typically the most abundant shade tolerant species for those stands currently assigned the MC cover type. In the northern portion of the project area in Sections 21,27, and 28, approximately 500 acres of the MC cover type contains a component of western hemlock. Western hemlock and grand fir share equal dominance of the species composition on approximately 135 acres of the 500 acres.

3.1.4 Stand Structure and Development

Stand structure and patch size indicates a characteristic of stand development and disturbance and how a stand may continue to develop. Stand structure is classified as single storied, two storied, or multi-storied. Patch size for this project is estimated from stand sizes and provides further insight into the severity of a disturbance as it relates to dominant tree canopies. Table 3-5 displays the % of area in the Foothills and Kalispell Landscape by stand structure class and estimates of stand size for each.

Table 3-5: Proportion (%) of Analysis Area by Stand Structure and Estimated Patch Size

Stand Structure	Kalispell Landscape	Kalispell Average Stand Size	Project Area	Project Area Average Stand Size
Single-storied	15%	24 acres	13%	17 acres
Two-storied	3%	28 acres	3%	33 acres
Multistoried	82%	31 acres	84%	38 acres

Single-storied stands are most often associated with stand replacement events, such as severe fires or regeneration harvests including clearcutting or seedtree cutting. Stands are fairly simple in vertical structure and are often even aged. Regeneration harvests, such as a seedtree or shelterwood, that retains 10% or more of the upper crown canopy and has a seedling/sapling understory are considered 2-storied stands. Two-storied stands have simple vertical structure and are frequently even aged, although at least two age classes are generally present. The multi-storied condition arises when a stand has progressed through time and succession to the point that shade-tolerant species are replacing a shade-intolerant overstory. Three or more age classes may be present in these stands and vertical structure can be complex. These stands often experience a long interval between disturbances. Stand size refers to openings created by disturbances and provides insight regarding the severity of a disturbance event regarding tree mortality. Larger patch sizes are generally associated with moderate and high severity fire regimes or regeneration harvests. Smaller sizes are attributed to low or moderate severity fire regimes, and harvest treatments that retain larger proportions of the overstory.

Over 80 % of both, Foothills project area and Kalispell Landscape consists of stands with multi-storied structures. The various tree canopy levels may be patchy in nature or well distributed and several age classes are usually present. Single or two-storied, even aged structures occur in less than 20% of the Foothills acreage and are largely represented by the younger age classes. The current average stand size for the Foothills area is 31 acres, ranging between 5 acres and 250 acres.

3.1.5 Timber Productivity and Value

Stem Decays: Timber productivity on more than 70% of the forested acreage within the Foothills project area is noticeably diminished by stem decay associated with Indian Paint Fungus *(Echinodontium tinctorium)* in mostly grand fir and western hemlock, and white pocket rot (*Fomes pini) [Same comment as above for use of common and scientific names.]* in Douglas-fir, western larch, and western white pine.

Indian paint fungus infection often occurs after trees are 40 years old. Damage is greater on wet sites at lower elevation in slow growing, dense stands, a common stand condition in the Foothills Project Area. Decay generally extends approximately 16 feet in either direction of bole conks resulting in a high percentage of defective wood. Infection may be controlled by, removing infected trees and avoiding wounding leave trees during harvest. White pocket rot decay extends 2 to 3 feet above and below swollen knots or conks and can also result in a large percentage of defect per tree if several conks or swollen knots are visible. This fungus enters trees through wounds, broken branches and tops, or roots. Avoiding damage to residual trees and removing trees with decay indicators or large wounds will reduce the effect of these stem decays*. (Forest Insect and Disease Management, USDA, FS-R1 Cooperative Forest and Pest Management, 1984).*

Insects: In the last few years, various species of bark beetles have been responsible for increased tree mortality in the Flathead Valley. In the 2003 Montana Forest Insect and Disease Conditions and Program Highlights Report 04-1, USDA –FS R1 & MT DNRC, the Swan Lake Ranger District reported historically high amounts of grand fir killed by the fir engraver (*Scolytus ventralis)* throughout mixed conifer stands*.* In the Foothills area, recent observations estimate 50% or more of the MC cover types to have similar levels of infestation and mortality as reported for the Swan District. The susceptibility of grand fir to the fir engraver appears to have increased as a result of droughty conditions weakening and stressing large numbers of trees. Endemic levels of various bark beetle activity is occurring in older age classes of western white pine and Douglas-fir throughout the project area as well.

Rusts: White pine blister rust is a nonnative disease that is the primary cause for decline of western white pine in the project area. Trees, of all age and size classes become infected from airborne spores. Some individual trees display a natural resistance to the infection, which may be a genetic attribute or due to limited exposure to infecting spores. Dead tops, profuse bleeding, or red - needled branches are signs of infected trees. The mountain pine beetle is often the final cause of mortality in blister rust stressed trees. Management recommendations include retaining mature white pine showing natural resistance and planting blister resistant seedlings in newly established stands.

3.1.6 Sensitive Plants

In past botanists' surveys, five separate populations of species of special concern, consisting of four different species were located within the Foothills project area. These all occurred within wetland complexes (*Pierce & Barton, 2001).* Plant populations include the following species: Giant helleborine (*Epipactis gigantean),* Mountain moonwort (*Botrychium montanum*), Buckler Fern (*Dryopterix cristata*), and Scorpion Moss (*Scorpidium scorpiodes*). The mountain moonwort population is located in a disturbed setting at the end of an open road (14A-4). This road would be used for accessing portions of harvest unit BL2. Population viability and habitat is considered marginal. Threats to this population would come from road traffic during spring months, herbicide treatments of invading weeds, or changing water and nutrient levels. A variety of wetland habitats exist within the project area, most with intact hydrologic and floristic components (*Kimball, 1998*). A particular exception to this is wetlands in Section 36, compromised as a result of past timber management activities and livestock grazing occurring during moist soil conditions.

3.1.7 Noxious Weeds

A majority of the Foothills project area has evidence of past logging activity and includes those acres within the harvest units. Invasions of noxious weeds are generally restricted to old logging roads and trails in less recently logged areas. Areas logged in the last few decades, however, have invasions spreading from the well established weed populations in the roads into adjacent openings. Native plant species may not recolonize these areas. Several factors increase the likelihood of continued weed encroachment in the Foothills area. They are: persistent and increasing usage of off road vehicles behind closures, creation of new trails or opening up old skid trails to reach firewood or for recreation, and mud bogging in wetlands accessible from private property or public roads. Weed species identified in field observations include: Canada thistle (*Cirsium arvense*), Spotted knapweed (*Centaurea maculosa*), St. John's-wort (*Hypericum perforatum*), Sulphur cinquefoil (*Potentilla recta*), Meadow hawkweed (*Hieracium pratense*), and Orange hawkweed (*Hieracium aurantiacum*). All these weeds are classified as Category 1 weeds for Flathead County, other than the hawkweeds which are Category 2. Category 1 refers to currently established and generally widespread weed populations throughout many counties of the state. Category 2 weeds are more recently introduced populations or those rapidly spreading from current infestation sites. Hawkweed is considered the latter, especially in the Bigfork and Ferndale areas.

In an effort to contain weed infestations or limit further encroachment, DNRC has contracted herbicide spraying for various parcels in the project area since 1996, focusing on the Patterson Creek area (Section 36) and open native surface roads and adjacent openings along public routes. Approximately 26 acres were sprayed in the Project Area in Fiscal Year 2005, and similar amounts were sprayed in previous years.

3.2 WATERSHED AND HYDROLOGY

Issues were raised that forest management activities may affect water quality parameters and water yield in project area watershed.

Water Quality: The primary parameter of concern for water quality is sediment. Stream temperature is addressed in the Fisheries analysis of this document. Increased sediment delivery and deposition can affect physical and biological water quality, channel stability and geomorphology. Sediment yield can be affected by a number of activities. Timber harvesting and associated road construction can increase sediment yield through exposure of bare soil. These impacts can be mitigated through implementation of Best Management Practices (BMPs), and other erosion control measures.

Water Yield: Timber harvesting and associated activities can affect the timing, distribution, and amount of water yield in a harvested watershed. Similarly, effects of stand replacement wildfire also affect water quantity and yield in a watershed. Water yields increase proportionately to the percentage of canopy removal, because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow and alters snowpack distribution and snowmelt, which lead to further water yield increases. Higher water yields may lead to increases in peak flows and peak-flow duration, which can result in accelerated streambank erosion and sediment deposition.

Analysis Methods

Water Quality Analysis Methods: Sediment delivery analysis was completed using a sediment source inventory methodology. All roads and stream crossings were evaluated to determine actual and potential sources of introduced sediment. In addition, in-channel sources of sediment were identified using channel stability rating methods developed by Pfankuch, and through the conversion of stability rating to reach condition by stream type developed by Rosgen (1996). These analyses were conducted in 1999 by a contracted firm and verified by a DNRC hydrologist. In addition, data were collected in 2005 to quantify sediment delivery using procedures adapted from the Washington Forest Practices Board (Callahan, 2000).

Water Yield Analysis Methods: An estimate of potential water yield increase for the watersheds in the project area was determined using the equivalent clearcut area (ECA) method as outlined in Forest Hydrology Part II (1976). ECA is a function of total area roaded and harvested, percent crown removal in harvest, and amount of vegetative recovery that has occurred in harvest areas. This method equates area harvested and percent crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60 percent crown removed, ECA would be approximately 60, or equivalent to a 60 acre clearcut. The relationship between crown removal and ECA is not a 1 to 1 ratio, so the percent ECA is not always the same as the percent canopy removal. This method also calculates the recovery of these increases as new trees vegetate the site and move toward pre-harvest water use.

In order to evaluate the watershed risk of potential water yield increase effectively, a threshold of concern must be established. In order to determine a threshold of concern, acceptable risk level, resource value, and watershed sensitivity are evaluated according to Young (1989). The watershed sensitivity is evaluated using qualitative assessments, as well as using procedures outlined in Haupt's Forest Hydrology Part II (1976). The stability of a stream channel is an important indicator of where a threshold of concern should be set. As water yields increase as a result of canopy removal, the amount of water flowing in a creek gradually increases. When these increases reach a certain level, the bed and banks may begin to erode. More stable streams will be able to handle larger increases in water yield before they begin to erode, while less stable streams will experience erosion at more moderate water yield increases.

Analysis Area

The Foothills Timber Sale project area includes State Trust Lands within T28N R19W Sections 21, 27, and 28, which all lie entirely within the Flathead Lake drainage (5^{th} code HUC 17010208010); T28N R19W Section 34, which lies partially within each the Flathead Lake drainage and Swan River drainage (5^{th} code HUC 17010211040); and, T27N R19W Sections 2, 3, 10, 11, 14, 23, 24, 35, and 36, which all lie entirely within the Swan River drainage. Up to 1,466 acres of total harvest area is proposed within the project area.

The project area includes specific portions of the watersheds of three disconnected tributaries of Flathead Lake. From north to south these are Krause Creek, Echo Creek, and Noisy Creek. The project area also includes specific portions of the watersheds of seven tributaries of the Swan River. From north to south these are Rocky Creek, Station Creek, Birch Creek, Deer Creek, Wolf Creek, Bear Creek, Peterson Creek, and Patterson Creek. A portion of the Swan River is within the project area, and this reach will be included in the direct and indirect effects analysis portion of this resource appendix.

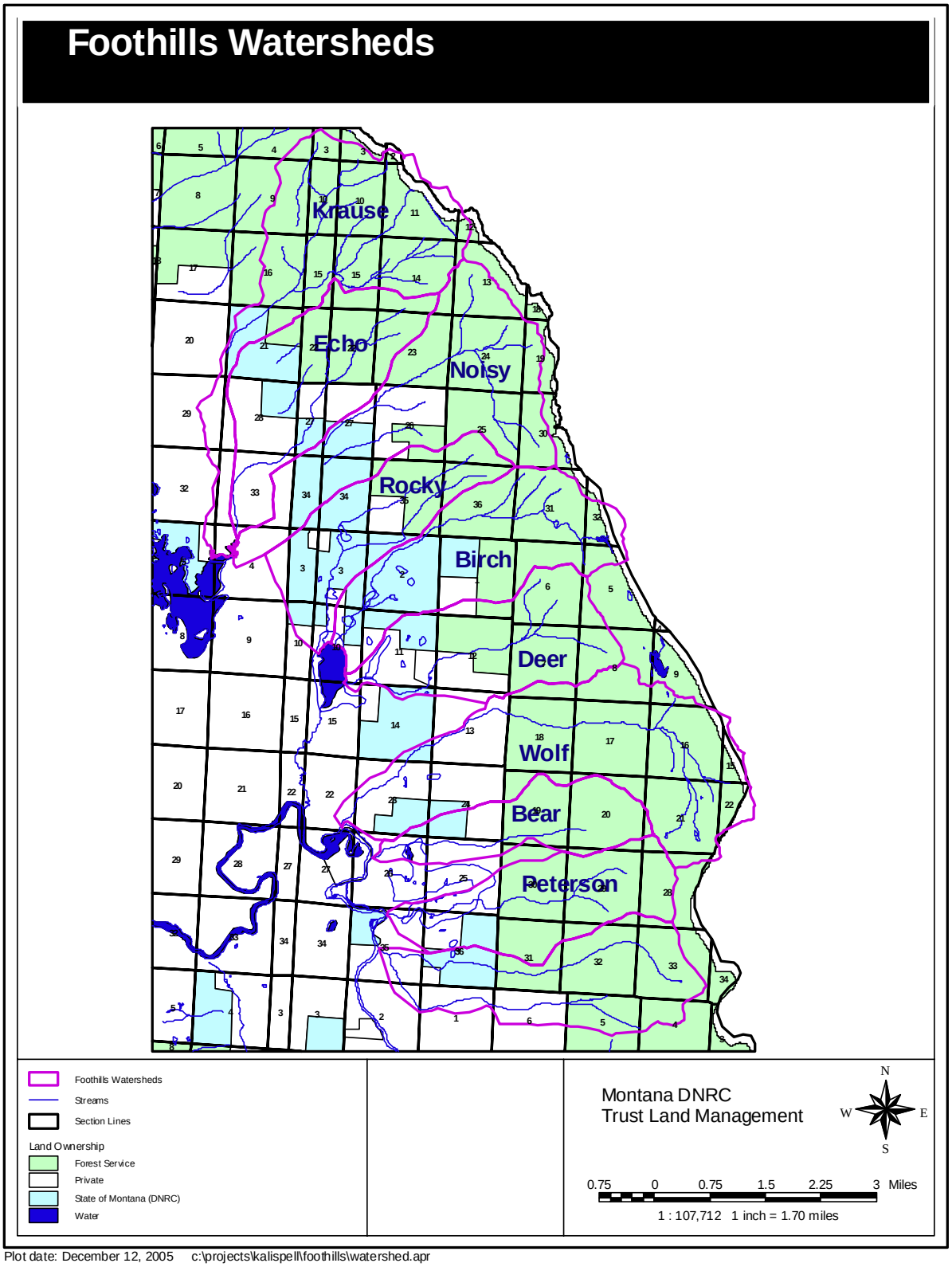
The downstream water bodies of Echo Lake, Mud Lake and Mud Creek are not within the project area and will not be included in the effects analysis portion of this resource appendix. None of the project alternatives are expected to have any direct, indirect, or cumulative effects with respect to downstream fisheries in the water bodies of Echo Lake, Mud Lake and Mud Creek.

Water Quality Analysis Area: The analysis area for water quality is the proposed project area, and all forest roads that lead into the project area from other ownership. The primary focus of the sediment delivery analysis was on the stream crossings located within the proposed project area.

Water Yield Analysis Area: The analysis area for water yield consists of the following watersheds: Bear Creek, Birch Creek, Deer Creek, Echo Creek, Krause Creek, Noisy Creek, Patterson Creek, Peterson

Creek, Rocky Creek and Wolf Creek. A map of the watershed boundaries for the streams in the Foothills analysis can be found in Figure 3-1.

Figure 3-1: Watershed Boundaries used for Water Yield Analysis Area.



Plot date: December 12, 2005 c:\projects\kalispell\foothills\watershed.apr

Regulatory Framework

Montana Surface Water Quality Standards: According to ARM 17.30.607 (1), the Flathead River drainage and its tributaries, including the Swan River, and Echo Lake, are all classified as B-1. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment and minimal increases in turbidity. "Naturally occurring," as defined by ARM 17.30.602 (17), includes conditions or materials present during runoff from developed land where all reasonable land, soil and water conservation practices (commonly called BMPs) have been applied. Reasonable practices include methods, measures or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and non-structural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities that may impact the resource.

Designated beneficial surface water uses within the project area include stock watering, irrigation, domestic use, power generation, lawn and garden, and fisheries.

Water Quality Limited Waterbodies: No streams in the proposed project area is listed in the 1996 or 2004 List of Waterbodies in Need of Total Maximum Daily Load (TMDL) Development publication produced by the Montana Department of Environmental Quality (DEQ, 1996, 2004).

Montana Streamside Management Zone (SMZ) Law: By the definition in ARM 36.11.312 (5), the streams in the proposed project area are class 1 streams. There are defined channels, most contribute surface flow to another body of water, and all are fish bearing.

3.2.1 Existing Conditions of Water Quality

Stream channels in the proposed project area were found to be primarily in fair to good condition. One reach received a poor stability rating: Deer Creek was found to have good bank stability, but an overall poor rating due to channel bed deposition. No in-channel sources of sediment were identified during field review of the project area streams. However, recent sideslope failures in the Strawberry Creek headwaters area have deposited fine glacial silts in Krause Creek in the project area. Additional discussion of stream channel characteristics can be found in the fisheries analysis portion of this document.

The existing road system in, and leading to, the proposed project area was reviewed for potential sources of sediment. Estimates for sediment delivery from the road systems in the Foothills Project Area by watershed are shown in Table 3-6 below. These values are listed only for DNRC-owned roads, and for non-DNRC roads proposed as haul routes. These sediment delivery values are estimates based on procedures outlined above, and are not measured values.

Estimated sediment delivery occurs primarily at stream crossings, and comes mainly from road surface delivery where surface drainage is not relieved prior to reaching the stream crossing. Some sediment is also reaching streams where fill slopes at stream crossings do not have adequate armor or erosion control. Most of the existing road system in the proposed project area is low to moderate standard. Portions of the road systems do not currently meet best management practices (BMP's) for surface drainage or erosion control. There are also several stream crossings that do not currently meet applicable BMPs. These sites are mainly a result of road construction that occurred before the adoption of Forest Management BMPs in Montana. These conditions have created some erosion problems. No other sources of erosion or deposition were identified through field review.

Table 3-6: Current Road Sediment Delivery Estimates in Foothills Project Area

	Watershed						
	Birch	Deer	Echo	Krause	Noisy	Patterson	Rocky
Sediment Yield (tons/yr)	0.02	0.02	3.7	0.03	1.2	0.12	8.8

3.2.2 Existing conditions of Water Yield

Timber management (both on public and private land) and recreational use are the primary land uses in the watersheds within the proposed project area. Timber management has been ongoing since the 1930s. These activities, conducted by the USDA Forest Service, F. H. Stoltze Land and Lumber Company, and the Montana DNRC, have led to reductions in forest canopy cover, and construction of roads.

Field reconnaissance of the proposed project area showed that stream channels, where they exist, are stable and not actively eroding. Based on channel conditions, the allowable water yield increase in each of the project area watersheds is 12% over a fully forested condition. Water yield increases resulting from past activities in each of the project area watersheds are shown below in Table 3-7. Small portions of the project area lie outside of project area watersheds. There are no stream channels or defined draws in these portions of the project area, so detrimental effects due to water yield increases are not a concern.

Table 3-7: Current Water Yield and ECA Increases in Foothills Project Area

		Watershed									
		Bear	Birch	Deer	Echo	Krause	Noisy	Patterson	Peterson	Rocky	Wolf
%WYI	Allowable	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	Existing	0.3	1.4	2.4	5.2	1.0	1.4	0.8	1.3	3.5	0.6
ECA	Allowable	495	931	787	861	1,169	1,145	837	712	679	1,464
	Existing	18	198	253	286	140	187	133	155	252	215

3.3 SOILS

The following concerns about soils were expressed during scoping:

- Soil productivity and stability may be adversely affected by forest management activities, especially near wetlands and streams.
- Erosion may increase as a result of timber harvest activities.
- Cutting near streams may increase runoff, bank erosion, and sedimentation.

The Swan River watershed is a valley formed by glaciers and river processes. The dominant soil types found in the project area are deep glacial tills and glacial outwash derived from argillite, siltite and limestone from the Belt Supergroup. Upper slopes and ridges are weathered bedrock scoured by glaciers.

Analysis Methods

Soil effects and conditions will be analyzed by evaluating the current levels of soil disturbance in the proposed project area. Analysis will also include assessing slope stability.

Analysis Area

The analysis area for evaluating soil productivity will include DNRC owned land within the Foothills project area. The proposed project area is found within the Krause Creek, Echo Creek, Noisy Creek, Rocky Creek, Birch Creek, Deer Creek, Wolf Creek, Bear Creek, Peterson Creek and Patterson Creek watersheds.

Existing Conditions

Soil types in the project area vary from nearly level glacial outwash and glacial till, including potholes and wetland types along the Swan River to steep mountain sideslopes on the east side of the proposed project area. The Upper Flathead Valley Area, Montana soils survey (USDA NRCS, 2004), and the Flathead National Forest Soil Survey (USDA, 1998) identified no areas of soils at high risk for mass

movements in the project area. No areas of slope instability were observed in the proposed project area during project review. A list of soil types found in the Foothills project area and their associated management implications is found in Table 3-8.

In the Foothills project area, DNRC has conducted timber harvesting since the early 1920s. Since timber sale records dating back to the 1940s, 3,635 acres have been harvested on state land using mainly ground-based harvest methods. Ground-based yarding can affect soil productivity through displacement and compaction of productive surface layers of soil, mainly on heavily used trails. Field review and aerial photo review of the proposed project area show that much of the proposed project area has been harvested in the past. Field reconnaissance shows that many of the existing trails from past management are well vegetated and past impacts (including ruts, erosion, compaction and displacement) are ameliorating from frost and vegetation. Minimal evidence of isolated soils erosion was observed within the project area. Based on field review, existing soils impacts on old harvest units in the proposed project area are estimated to be 10% or less of the previously harvested areas.

Table 3-8: Soil Map Unit Descriptions for the Foothills Project Area

Map Unit	Description	Soil Drainage	Road Limitations	Topsoil Displacement & Compaction	Seedling Estab-lishment	Erosion (Bare Surface)	Notes
10-2	Alluvial Soils	Poor to Well Drained	Mod to Severe	Severe	Good	Low	Streamside management guides will be applied.
14-3	Silty Lacustrine terraces, 0-20%	Somewhat Poor	Poor Bear-ing Strength	Severe if wet	Good	High	Soil has very limited season of use, consider winter harvest, designated skid trails. Roads may require turnpiking, special design, gravel. Lop & scatter slash, excavator pile or broadcast burn.
26C-7	Glacial Moraines, 0-20%	Well Drained	Low	Moderate (Severe if wet)	Good	Low	Deep, productive soil. Topsoil depth important.
26D-7	Glacial Moraines, 0-20%	Well Drained	Moderate	Moderate	Good	Moderate	Deep, productive soil. Topsoil depth important.
27-7	Glacial Kames and Kettles, 10-20% Slopes	Well Drained	Low	Low	Fair	Moderate	Deep soil, low fertility. Topsoil depth is very important.
28-7	Glacial Outwash, 0-20%	Well Drained	Low	Moderate	Moderate - Droughty	Low	Topsoil depth is very important.

3.4 FISHERIES

The issue was raised that forest management activities may affect fisheries in the project area and associated drainages.

The Foothills Timber Sale project area includes State Trust Lands within T28N R19W Sections 21, 27, and 28, which all lie entirely within the Flathead Lake drainage (5th code HUC 17010208010); T28N R19W Section 34, which lies partially within each the Flathead Lake drainage and Swan River drainage (5th code HUC 17010211040); and, T27N R19W Sections 2, 3, 10, 11, 14, 23, 24, 35, and 36, which all lie entirely within the Swan River drainage. Up to 1,468 acres of total harvest area is proposed within the project area.

The project area includes specific portions of the watersheds of three disconnected tributaries of Flathead Lake. From north to south these are Krause Creek, Echo Creek, and Noisy Creek. The project area also includes specific portions of the watersheds of seven tributaries of the Swan River. From north to south these are Rocky Creek, Station Creek, Birch Creek, Deer Creek, Wolf Creek, Bear Creek, Peterson Creek, and Patterson Creek. A portion of the Swan River is within the project area, and this reach will be included in the direct and indirect effects analysis portion of Chapter 4.

The downstream water bodies of Echo Lake, Mud Lake and Mud Creek are not within the project area and will not be included in the effects analysis portion of Chapter 4. None of the project alternatives are expected to have any direct, indirect, or cumulative effects with respect to downstream fisheries in the water bodies of Echo Lake, Mud Lake and Mud Creek.

Krause Creek, Echo Creek, Noisy Creek, Rocky Creek, Station Creek, Birch Creek, Deer Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and Swan River are not identified on the 1996, 2002 or draft 2004 Montana 303(d) lists as impaired streams.

The portions of the Flathead Lake and Swan River drainages that include all stream reaches within the project area and any contributing subbasins are classified as B-1 in the Montana Surface Water Quality Standards (ARM 17.30.608). The B-1 classification is for multiple beneficial use waters including the growth and propagation of cold-water fisheries and associated aquatic life. Among other criteria for B-1 waters, a 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF (0ºC to 18.9ºC), and no increases are allowed above naturally occurring concentrations of sediment or suspended sediment, which will harm or prove detrimental to fish or other wildlife. In regards to sediment, naturally occurring includes conditions or materials present from runoff or percolation from developed land where all reasonable land, soil and water conservation practices have been applied (ARM 17.30.603(19)). Reasonable practices include methods, measures or practices that protect present and reasonably anticipated beneficial uses (ARM 17.30.603(24). The State has adopted Forestry Best Management Practices (BMPs) through its Non-point Source Management Plan as the principle means of controlling non-point source pollution from silvicultural activities (Thomas et al 1990).

Species

Native cold-water fish species within the project area include bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), largescale sucker (*Catostomus macrocheilus*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), mountain whitefish (*Prosopium williamsoni*), northern pike minnow (*Ptychocheilus oregonenis*), peamouth (*Mylocheilus caurinus*), redside shiner (*Richardsonius balteatus*), and slimy sculpin (*Cottus cognatus*). Non-native species known to persist within the specific project area are eastern brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), kokanee (*Oncorhynchus nerka*), largemouth bass (*Micropterus salmoides*), and northern pike (*Esox lucius*).

Largescale sucker, longnose dace, longnose sucker, mountain whitefish, northern pike minnow, peamouth, redside shiner, and slimy sculpin are not identified as endangered, threatened, or sensitive species (MNHP 2004).

Bull trout and westslope cutthroat trout are the primary native, cold-water species that will be addressed in this fisheries analysis. Bull trout are listed as “threatened” under the Endangered Species Act. Both bull trout and westslope cutthroat trout are listed as Class-A Montana Animal Species of Concern. A Class-A designation is defined as a species or subspecies that has limited numbers and/or habitats both

in Montana and elsewhere in the North America and elimination from Montana would be a significant loss to the gene pool of the species or subspecies (Montana Fish, Wildlife and Parks (FWP), Montana Natural Heritage Program, and Montana Chapter American Fisheries Society Rankings). The DNRC has also identified bull trout and westslope cutthroat trout as sensitive species (Administrative Rule of Montana [ARM] 36.11.436).

Both bull trout and westslope cutthroat trout exhibit resident, fluvial and adfluvial life forms. Resident life forms spend their juvenile and adult life in natal or nearby low order tributaries. Fluvial and adfluvial life forms generally leave their natal streams within one to three years of emergence (Shepard et al 1984, Fraley and Shepard 1989) to mature in downstream river and lake systems, respectively, and then return again to headwater or upstream reaches to spawn. Fluvial and adfluvial life forms of bull trout and westslope cutthroat trout are typically larger than resident fish, and bull trout have been observed returning to upstream reaches during successive or alternating years to spawn (Fraley and Shepard 1989). Overall, the life forms and stages of bull trout and westslope cutthroat trout have evolved to coexist in overlapping geographic areas (Nakano et al 1992, Pratt 1984, Shepard et al 1984).

Fluvial and adfluvial bull trout generally mature at ages 5-6, begin upstream spawning migrations in April, and spawn between September and October in response to a temperature regime decline below 9-10ºC (Fraley and Shepard 1989). Spawning adult bull trout are known to construct redds in close association with upwelling groundwater and proximity to overhanging or instream cover (Fraley and Shepard 1989). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to bull trout embryo and juvenile survival (MBTSG 1998, Weaver and Fraley 1991, Pratt 1984).

Resident westslope cutthroat trout have been observed maturing at ages 3-5 (Downs et al 1997), and all life forms are known to spawn during May through June (Shepard et al 1984). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to westslope cutthroat trout embryo and juvenile survival (Pratt 1984).

Streams Excluded from Fisheries Analysis

All potential fish bearing streams within the project area were surveyed during 1999, 2004, and 2005 for fisheries presence (see Figure 3-2 and Figure 3-3 – Foothills Timber Sale Fish Presence). Streams that were surveyed for fish presence and determined to not contain any fish populations or provide fish habitat are considered non-fish bearing. Non-fish bearing streams are not addressed in this fisheries analysis and include:

- Upper Rocky Creek. A field survey during 2005 indicates that the reach of this stream within the project area exhibits disconnected channel morphology due to an extensive marsh complex. The reach also exhibits very low seasonal flows, an unstable channel morphology, and insufficient spawning, rearing, or wintering habitat. No fish have been observed in this reach.
- Station Creek. Field surveys during 2004 and 2005 indicate that the perennial reach of this stream within the project area exhibits very low seasonal flows, an unstable channel morphology, and insufficient spawning, rearing, or wintering habitat. No fish have been observed in this reach.
- Deer Creek. During 2004 a fish passage assessment on Deer Creek within the project area revealed that this reach is non-fish bearing. No fish have been observed in this reach.

Figure 3-2. Foothills Timber Sale Fish Presence**.**

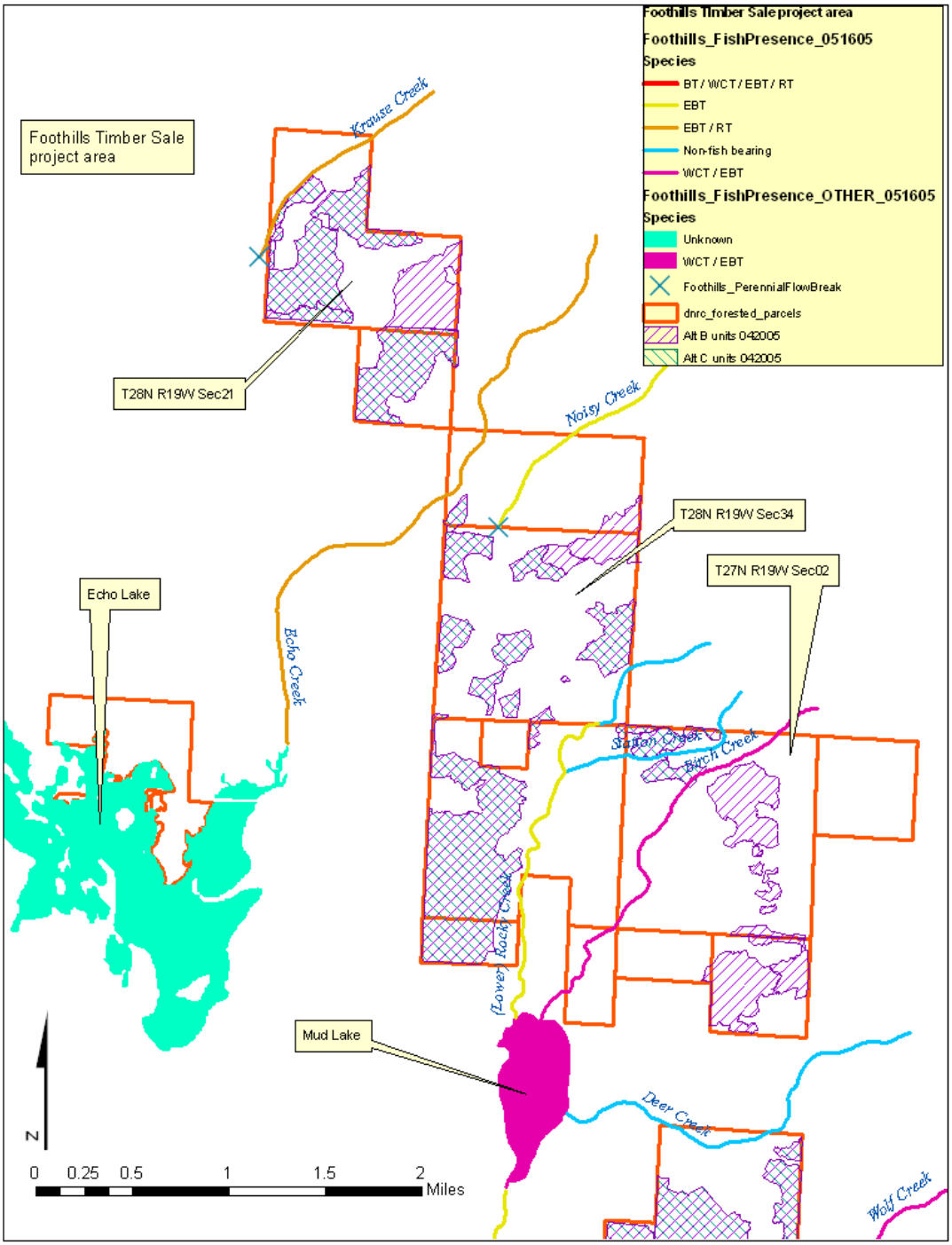
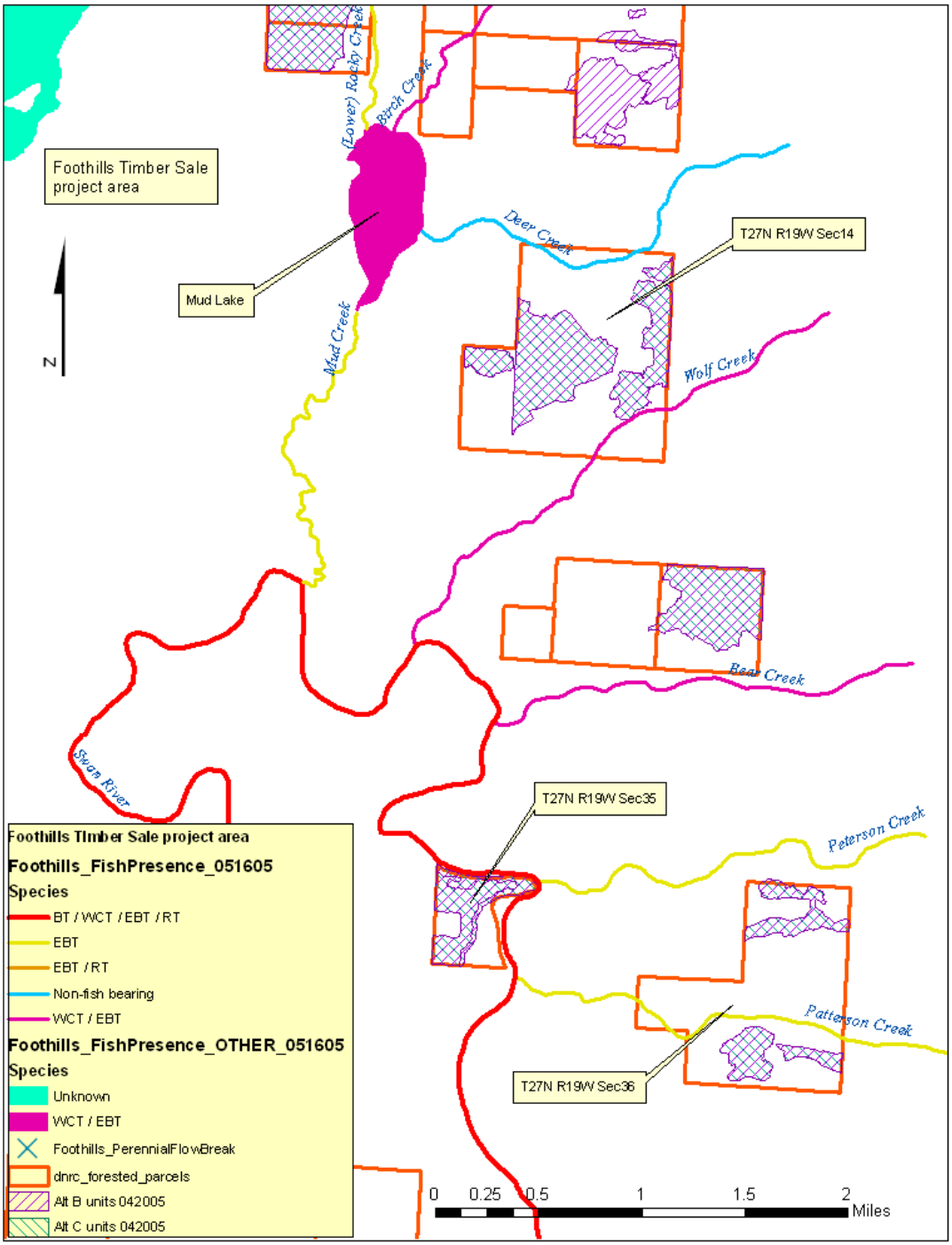


Figure 3-3. Foothills Timber Sale Fish Presence.



Analysis Methods and Subissues

The existing conditions of fisheries populations and habitat will be described in this analysis. In Chapter 4 those existing conditions will then be compared to the anticipated effects of the project alternatives to determine the foreseeable impacts to fisheries.

Analysis methods are a function of the types and quality of data available for analysis, which varies among the different watersheds in the project area. The analyses may either be quantitative or qualitative. The best available data for both populations and habitats will be presented for Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and Swan River. Existing conditions and foreseeable environmental effects for each stream system will be explored using the following outline of subissues:

- POPULATIONS – PRESENCE AND GENETICS
- HABITAT – FLOW REGIMES
- HABITAT – SEDIMENT and CHANNEL FORMS
- HABITAT – RIPARIAN FUNCTION, LARGE WOODY DEBRIS, and STREAM TEMPERATURE
- HABITAT – CONNECTIVITY
- CUMULATIVE EFFECTS

3.4.1 Populations – Presence and Genetics

Krause Creek, Echo Creek, and Noisy Creek all lay within the Echo Lake watershed. No native fish species are known to inhabit the lake or the three tributaries, and the lake system is regularly stocked with rainbow trout, kokanee, and largemouth bass. Eastern brook trout have also been introduced to the system. Rainbow trout and eastern brook trout populations have consequently spread to Krause Creek (S. Rumsey (FWP Kalispell, personal communication, 2005)) and Echo Creek (MFISH 2005), which are connected to Echo Lake via perennial flow through Echo Creek and diversion ditches from Krause Creek. Noisy Creek is disconnected from Echo Lake except during unusually high flow events, however eastern brook trout have invaded the perennial reach of the creek and continue to persist there through a well-established resident population. There are no apparent existing direct or indirect impacts to the non-native fisheries in Krause Creek, Echo Creek, or Noisy Creek.

Lower Rocky Creek and Birch Creek lay within the Mud Lake watershed. Native westslope cutthroat trout are known to inhabit the watershed, but their current distribution is limited to Mud Lake and Birch Creek (MFISH 2005). The genetic status of westslope cutthroat trout within the watershed is unknown, but some level of hybridization may exist since records of contaminating species, such as rainbow trout, are known to persist within the greater Swan River watershed (NRIS 2004). Eastern brook trout have also invaded the watershed and are known to inhabit Mud Creek, Mud Lake, lower Rocky Creek, and Birch Creek (MFISH 2005, Gardner 1997).

Westslope cutthroat trout face considerable threats from the introduction and spread of non-native fish. Introgression from hybridization with rainbow trout and other cutthroat trout subspecies may pose the foremost risk to westslope cutthroat trout in Montana (Liknes and Graham 1988). Westslope cutthroat trout are also quite susceptible to displacement by introduced salmonids, especially eastern brook trout, however the variable mechanisms through which this occurs are not well understood (Griffith 1988). Existing impacts to westslope cutthroat trout in Birch Creek and Mud Lake therefore include (1) a potential moderate direct or indirect impact due to introgression from rainbow trout hybridization and (2) a low to moderate direct or indirect impact from displacement by eastern brook trout. There are no apparent existing direct or indirect impacts to non-native fisheries in lower Rocky Creek and Birch Creek.

Wolf Creek and Bear Creek are perennially connected streams to the Swan River. Both Wolf Creek and Bear Creek are populated by westslope cutthroat trout and eastern brook trout. Northern pike minnow also inhabit Bear Creek (MFISH 2005). Westslope cutthroat trout in Wolf Creek are known to exhibit a genetic purity of 98% due to introgression with rainbow trout (NRIS 2004). The genetic status of westslope cutthroat trout within Bear Creek is unknown, but some level of hybridization may exist since

records of contaminating species, are known to persist within the greater Swan River watershed (NRIS 2004). Existing impacts to westslope cutthroat trout in Wolf Creek and Bear Creek include (1) a moderate direct or indirect impact due to introgression from rainbow trout hybridization and (2) a low to moderate direct or indirect impact from displacement by eastern brook trout. There are no apparent existing direct or indirect impacts to non-native and other native fisheries in Wolf Creek and Bear Creek.

Peterson Creek and Patterson Creek are perennially connected streams to the Swan River. Both creeks are known to have been invaded and populated by eastern brook trout (MFISH 2005, S. Rumsey (FWP Kalispell, personal communication, 2005)). Past fisheries surveys conducted by FWP (S. Rumsey (FWP Kalispell, personal communication, 2005)) in both creeks have not detected the presence of westslope cutthroat trout. However, since eastern brook trout were able to freely invade both streams via the Swan River, at some point prior to the invasion one more life stages of native westslope cutthroat trout also occupied the streams. Westslope cutthroat trout likely persist today in isolated reaches of both creeks (S. Rumsey (FWP Kalispell, personal communication, 2005)). Existing impacts to westslope cutthroat trout in Peterson Creek and Patterson Creek likely include a moderate to high direct or indirect impact from displacement by eastern brook trout. There are no apparent existing direct or indirect impacts to non-native fisheries in Peterson Creek and Patterson Creek.

Native fish species in the Swan River within and adjacent to the project area include: bull trout, westslope cutthroat trout, largescale sucker, longnose dace, longnose sucker, mountain whitefish, northern pike minnow, peamouth, redside shiner, and slimy sculpin. Non-native species include: eastern brook trout, rainbow trout, kokanee, largemouth bass, northern pike, and yellow perch. The lower Swan River within the project area has not been identified as core or nodal habitat area within the Swan River drainage bull trout conservation area (MBTSG 1996, MBTRT 2000). Core areas are generally undisturbed water bodies used for spawning and early rearing, and nodal habitats are generally described as critical migratory and overwintering areas. The lower Swan River is nonetheless utilized by bull trout as limited rearing and migratory habitat for adfluvial populations associated with Swan Lake. Hybrids of bull trout and eastern brook trout are known to exist in the lower Swan River (MFISH 2005). Westslope cutthroat trout populations in the lower Swan River are known to exhibit both pure and introgressed individuals (NRIS 2004).

Perhaps the greatest future threats to bull trout in the Swan River drainage are from the introduction and spread of non-native fish (MBTSG 1996). The recently confirmed introduction and reproduction of lake trout (*Salvelinus namaycush*) in Swan Lake is expected to have some level of acute negative effect to bull trout within the Swan River drainage. Lake trout will negatively affect bull trout populations in Swan Lake through the predation of juvenile and sub-adult life stages and niche displacement. These foreseeable interactions will likely be expressed through lower bull trout population densities.

Existing impacts to bull trout and westslope cutthroat trout populations and genetics in the lower Swan River are due primarily to the introduction of non-native salmonids. Existing impacts to bull trout in the lower Swan River include an imminent low to high impact due to the propagation of lake trout in the drainage and a low impact due to hybridization with eastern brook trout. Existing impacts to westslope cutthroat trout include a moderate impact due to introgression from hybridization and a low impact from displacement by eastern brook trout. There are likely low existing impacts to other native fisheries in the lower Swan River due to the introduction or invasion of non-native fish species. There are no apparent existing direct or indirect impacts to non-native fish species.

3.4.2 Habitat – Flow Regimes

Flow regime is the range of discharge frequencies and intensities in a specific watershed that occur throughout the year. The analysis of hydrologic data for stream basins in the project area indicates that the existing average departure in flow regime ranges from approximately 0.3 to 5.2 percent above the range of naturally occurring conditions (see Hydrology Analysis), which is primarily a result of past forest crown removal. The range of naturally occurring conditions is considered representative of those flow regimes in a mature forest. Available data is described in Table 3-9. Although no data is available for the

Swan River, the existing average departure in flow regime ranges for the river is likely representative of those streams in the project area where such information is available.

TABLE 3-9: Average departure of flow regime ranges from basins in the Foothills Timber Sale project area.

Stream basin	Percent departure in average existing flow regime from the range of naturally occurring conditions
Krause Creek	1.0%
Echo Creek	5.2%
Noisy Creek	1.4%
Rocky Creek and Station Creek	3.5%
Birch Creek	1.4%
Wolf Creek	0.6%
Bear Creek	0.3%
Peterson Creek	1.3%
Patterson Creek	0.8%

Changes in flow regime can affect native and non-native fisheries through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. However, the existing levels of increased flow regime in the project area are generally not associated with detectable impacts to fish habitat variables. As a consequence, there is a very low potential for existing direct and indirect impacts to these habitat characteristics as a result of the estimated 0.3 to 5.2 percent increases in flow regime to fish-bearing streams throughout the project area.

Changes in flow regime have been known to affect native and non-native fish species spawning migration, habitat available for spawning, and embryo survival. Although, in general, the existing levels of increased flow regime described for the project area are not likely to have adverse impacts to fisheries spawning and embryo survival. For this reason, there is a very low potential for existing direct and indirect impacts to native and non-native fish species as a result of flow regime modifications to fish-bearing streams throughout the project area.

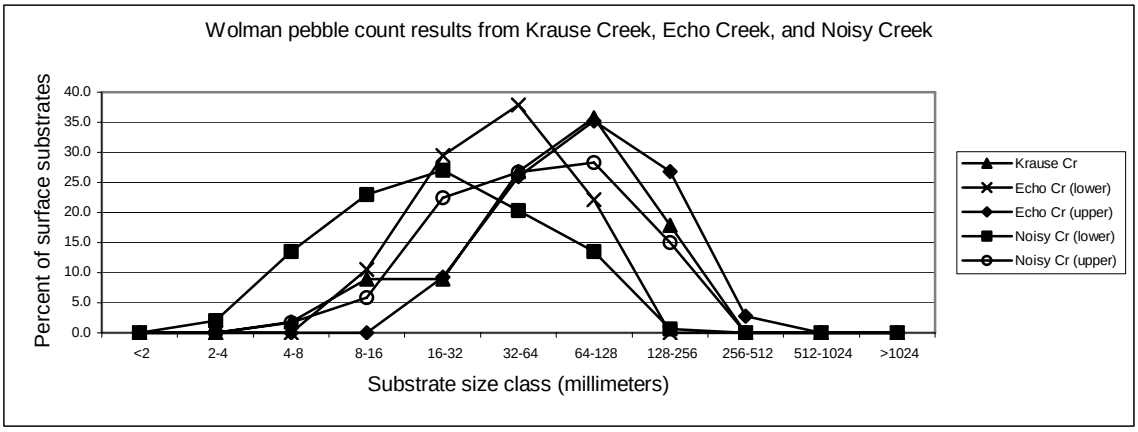
3.4.3 Habitat – Sediment and Channel Forms

Sediments and channel forms are broad stream variables that help describe fisheries habitat conditions related to streambed substrates and stream morphologies. Existing stream sediment and channel form processes are described in this Fisheries Analysis through Rosgen stream morphological type, substrate characterization, and streambank stability. The stream morphologies within the project area are described using Rosgen river classification (Rosgen 1996). The Wolman pebble count (Wolman 1954) and visual estimates are the methods used to characterize existing substrate size classes on the streambed surface. Streambank stability will be described using Pfankuch (1978) and visual estimates.

DNRC technical survey data indicates that Krause Creek within the project area exhibits a B3 Rosgen morphologic stream type with an average gradient of 2 to 3 percent. The B morphological type broadly includes riffle-dominated streams in narrow, gently sloping valleys, which typically exhibit infrequently spaced pools (Rosgen 1996). Furthermore, the B3 morphological type is characteristic of channel compositions dominated by cobbles and co-dominated by boulders with lesser amounts of gravel and sand (Rosgen 1996). The average bankfull width is 12-13 feet. Wolman pebble count data from Krause Creek is displayed in Figure 3-4, which indicates low total percentages of fine (2 percent) and gravel (18 percent) substrate classes and a high total percentage of cobbles (80 percent). However, recent sideslope failures in the Strawberry Creek headwaters area have deposited high levels of fine glacial silts in Krause Creek in the project area. These glacial silts temporarily increase the proportion of fine streambed substrates, which tends to reduce the quality of the sediment component of cold-water fisheries habitat. Two road-stream crossings of Krause Creek upstream of the project area on other land

ownerships have likely contributed an unknown amount of fine sediments to the stream. Pfankuch streambank stability scores from surveys in 1980 and 1999 were 98 and 69, respectively. As lower scores indicate greater stability, these survey results may indicate a trend towards greater streambank stability in Krause Creek. Lower streambank stability scores generally indicate lower levels of bank erosion, which can also translate to lower levels of in-stream sedimentation and higher quality native fish habitat. The reason for a trend in greater streambank stability is likely due to an irrigation diversion built prior to 1964 on Forest Service land upstream of the project area. The irrigation diversion has rerouted a major portion of flows from Krause Creek within the project area, and this has likely led to a reduction in seasonal peak flows. A reduction in seasonal peak flows will typically result in lower levels of seasonal bank erosion and greater streambank stability over time. Although there may be an existing trend towards greater streambank stability, there is likely low to moderate levels of existing direct and indirect impact to non-native fisheries in Krause Creek due to (1) recent influxes of glacial silts from the Strawberry Creek headwaters and (2) the potential introduction of fine sediments from two road-stream crossings upstream of the project area. As native fisheries are not known to have ever existed in Krause Creek, there are no direct or indirect existing impacts to native fisheries.

Figure 3-4. Wolman pebble count results from Krause Creek, Echo Creek, and Noisy Creek.



DNRC technical survey data indicates that lower Echo Creek within the project area exhibits a B4 Rosgen morphologic stream type with an average gradient of 3 percent, and upper Echo Creek within the project area exhibits an A3 Rosgen morphologic stream type with an average gradient of 5 percent. The B4 morphological type is characteristic of channel compositions dominated by gravels with lesser amounts of cobble and sand (Rosgen 1996). The A3 morphological type includes streams with steep, entrenched, confined channels that are dominated by cobbles with lesser amounts of boulders, gravel, and sand (Rosgen 1996). The average bankfull width is 8 to 9 feet. Wolman pebble count data from Echo Creek is displayed in Figure 3-4. The lower Echo Creek reach was surveyed to have an average streambed substrate composition of 40 percent gravel and 60 percent cobble. The upper Echo Creek reach was surveyed to have an average streambed substrate composition of 35 percent gravel, 62 percent cobble, and 3 percent boulder. Pfankuch streambank stability scores of lower Echo Creek from surveys in 1980 and 1999 were 72 and 74, respectively, which likely indicates a stable stream reach over time. The Pfankuch streambank stability score of upper Echo Creek from a 1999 survey is 69. Streambank stability scores of 37 to 76 are considered to have a rating of 'good' streambank stability (Pfankuch 1978). There are two road-stream crossings of Echo Creek upstream of the project area on other land ownerships that have likely contributed an unknown amount of fine sediments to the stream. There is a potential for very low existing direct and indirect impacts to non-native fisheries in Echo Creek due to the potential introduction of fine sediments from two road-stream crossings upstream of the project area.

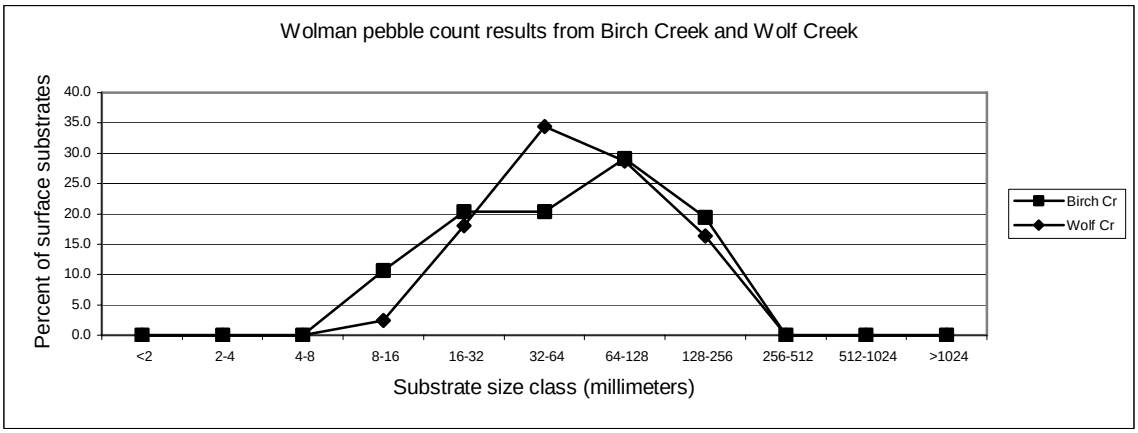
DNRC technical survey data indicates that the lower fish-bearing reach of Noisy Creek within the project area exhibits a C4 Rosgen morphologic stream type with an average gradient of 1-2 percent, and the upper fish-bearing reach of Noisy Creek within the project area exhibits a B4 Rosgen morphologic stream type with an average gradient of 3 percent. The C4 morphological type is indicative of gravel-dominated

systems with well-developed floodplains (Rosgen 1996). The average bankfull width is 8-15 feet. Wolman pebble count data from Noisy Creek is displayed in Figure 3-4. The lower Noisy Creek reach was surveyed to have an average streambed substrate composition of 16 percent fines, 50 percent gravel, and 34 percent cobble. The upper Noisy Creek reach was surveyed to have an average streambed substrate composition of 2 percent fines, 28 percent gravel, and 70 percent cobble. Pfankuch streambank stability scores of lower Noisy Creek from surveys in 1980 and 1999 were 87 and 102, respectively, which may indicate that this reach is not in morphological equilibrium and is displaying lower streambank stability. However, C stream types tend to migrate laterally with a relatively high frequency, and these processes typically generate higher streambank stability scores than A or B stream types. The Pfankuch streambank stability score of upper Noisy Creek from a 1999 survey is 76. The Wolman pebble count results and streambank stability scores for Noisy Creek are within the expected ranges of conditions for the corresponding stream types. There is one road-stream crossing of Noisy Creek upstream of the project area on another land ownership that has likely contributed an unknown amount of fine sediments to the stream. There is a potential very low existing direct and indirect impact to non-native fisheries in Noisy Creek due to the potential introduction of fine sediments from the one road-stream crossing upstream of the project area.

DNRC field surveys indicates that the lower reach of Rocky Creek within the project area exhibits an E4 Rosgen morphologic stream type with an average gradient of 1 percent, which transforms at the upper end of the stream segment to a B4 stream type with an average gradient of 4 to 6 percent. E4 stream types are characteristic of channels dominated by riffles and pools, low to moderate sinuosity, and streambeds composed primarily of gravel (Rosgen 1996). The average bankfull width in the E4 stream type reach is 4 feet, and the average bankfull width in the B4 stream type reach width is 7 feet. Visual estimates of channels substrates in E4 reach indicate that the proportions of the different substrate classes are approximately 35 percent fines, 60 percent gravels, and 5 percent cobbles. The streambanks within the E4 and B4 reaches are stable, and no areas of substantially active, persistent streambank erosion were observed that would indicate a trend towards channel instability. There are eight road-stream crossings of Rocky Creek and Station Creek both within the project area and upstream of the project area on other land ownerships, which have likely contributed an unknown amount of fine sediments to the stream system. There is a potential low existing direct and indirect impact to non-native fisheries in lower Rocky Creek due to the potential introduction of fine sediments from the eight road-stream crossings both within the project area and upstream of the project area.

DNRC technical survey data indicates that Birch Creek within the project area exhibits a B4 Rosgen morphologic stream type with an average gradient of 4 percent. The average bankfull width is 11-12 feet. Wolman pebble count data from Birch Creek is displayed in Figure 3-5. Birch Creek was surveyed to have an average streambed substrate composition of 31 percent gravel and 69 percent cobble. The Pfankuch streambank stability score from a 1999 survey was 84, which may indicate that this reach is moderately unstable. B4 stream types typically exhibit a relatively stable morphology (Rosgen 1996). There are three road-stream crossings of Birch Creek both within the project area and upstream of the project area on other land ownerships, which have contributed an unknown amount of fine sediments to the stream system. Two of the road-stream crossings in the project area have failed under high flow conditions, and this has resulted in large introductions of fine sediment to Birch Creek. Due to survey results that may indicate moderate channel instability in this reach and the known introduction of fine sediments from two failed road-stream crossings, there is likely a low to moderate direct and indirect existing impact to the sediment and channel form habitat features for native or non-native fisheries in Birch Creek.

Figure 3-5. Wolman pebble count results from Birch Creek and Wolf Creek.



DNRC technical survey data indicates that Wolf Creek within the project area exhibits a B4 Rosgen morphologic stream type with an average gradient of 2 percent. The average bankfull width is 13 to 14 feet. Wolman pebble count data from Wolf Creek is displayed in Figure 3-5. Wolf Creek was surveyed to have an average streambed substrate composition of 21 percent gravel and 79 percent cobble. The Pfankuch streambank stability score from a 1999 survey was 57. There is one road-stream crossing of Wolf Creek upstream of the project area on another land ownership that has likely contributed an unknown amount of fine sediments to the stream. There is a potential very low existing direct and indirect impact to native and non-native fisheries in Wolf Creek due to the potential introduction of fine sediments from the one road-stream crossing upstream of the project area.

As both Bear Creek and Peterson Creek flow through private lands within the project area, technical survey data of sediments and channel forms were not obtained for this analysis. There are two road-stream crossings of Bear Creek upstream of the project area on other land ownerships that have likely contributed an unknown amount of fine sediments to the stream. Additionally, there are three road-stream crossings of Peterson Creek upstream of the project area on other land ownerships that have likely contributed an unknown amount of fine sediments to the stream. As a result, there is a potential low existing direct and indirect impact to the native and non-native fisheries in Bear Creek and Peterson Creek due to the potential introduction of fine sediments from road-stream crossings upstream of the project area.

DNRC field surveys indicate that Patterson Creek within the project area exhibits a B4 Rosgen morphologic stream type with an average gradient of 5 to 6 percent. The average bankfull width in the B4 stream type reach width is 8 feet. Visual estimates of channels substrates indicate that the proportions of the different substrate classes are approximately 20 percent fines, 65 percent gravels, 10 percent cobbles, and 5 percent boulders. The streambanks within the reach are stable, and no areas of substantially active, persistent streambank erosion were observed that would indicate a trend towards channel instability. There are four road-stream crossings of Patterson Creek both within the project area and upstream of the project area on other land ownerships, which have likely contributed an unknown amount of fine sediments to the stream system. There is a potential very low to low existing direct and indirect impact to the native and non-native fisheries in Patterson Creek due to the potential introduction of fine sediments from the four road-stream crossings both within the project area and upstream of the project area.

DNRC field surveys indicate that the Swan River within the project area exhibits a C3 Rosgen morphologic stream type with an average gradient of 1 percent. The C3 morphological type is indicative of cobble-dominated systems with well-developed floodplains (Rosgen 1996). Visual estimates of channels substrates indicate that the proportions of the different substrate classes are approximately 10 percent fines, 10 percent gravels, 70 percent cobbles, and 10 percent boulders. The streambanks within the reach are relatively stable, and no areas of substantially active, persistent streambank erosion were

observed that would indicate a trend towards channel instability. There is one bridge crossing of the Swan River immediately upstream of the project area on other land ownerships, which may have contributed an unknown amount of fine sediments to the river system. There is a potential very low existing direct and indirect impact to the native and non-native fisheries in the Swan River due to the potential introduction of fine sediments from the bridge crossing upstream of the project area.

3.4.4 Habitat – Riparian Function, Large Woody Debris, and Stream Temperature

The stream riparian area is broadly defined as the interface or linkage between the terrestrial and aquatic zones, and this area is critical for regulating large woody debris recruitment, the interception of solar radiation, stream nutrient inputs, and other variables (Hansen et al 1995). Studies of large woody debris recruitment to the stream channel suggest that the primary zone of recruitment is equal to the height of the tallest trees growing in the riparian zone (Robinson and Beschta 1990, Bilby and Bisson 1998). The site potential tree height at 100 years (ARM 36.11.425(5)) is used to estimate the extent of the primary zone of large woody debris recruitment for riparian areas adjacent to proposed harvest units. Riparian areas also provide stream shading, which contributes to the regulation of stream temperature regimes by intercepting direct solar radiation to the stream channel. During the winter season riparian areas may also function to regulate stream temperatures by inhibiting temperature loss through evaporation, convection, or long-wave radiation from the stream (Beschta et al 1987).

Site potential tree heights from the riparian areas along streams within the project area were calculated from sample trees located approximately 50 feet from bankfull edges. Samples of site potential tree height were taken from free-growing trees, and the species composition of the sample sets are representative of the proportion of different tree species within the specified riparian areas. Results from the sampling are displayed in Table 3-10.

TABLE 3-10: Calculations of site potential tree height along streams in the Foothills Timber Sale project area.

Stream	Number of site potential tree height samples	Sample year	Average site potential tree height at 100 years
Krause Creek	21	2005	90
Echo Creek	19	2005	95
Noisy Creek diversion	21	2005	103
Noisy Creek	21	2005	105
Station Creek	21	2005	88
Birch Creek	21	2005	101
Wolf Creek	21	2005	91
Patterson Creek	21	2005	119
Swan River	21	2005	93

Very light past riparian harvest, which here includes the harvest of occasional individual trees more than 50 years ago, has been observed along nearly all of the fish-bearing streams on state trust lands in the project area. This very light riparian harvest has not likely had any adverse effects that continue today.

However, some past riparian harvest along streams may continue to have an existing impact to large woody debris recruitment and stream shading. Within the project area, past riparian harvest may have occurred along approximately 950 feet of Krause Creek during the early 1980s. Past selective riparian harvest has also likely occurred along approximately 450 feet of Birch Creek and along approximately 2700 feet of the Swan River. Past riparian timber harvest on other land ownerships outside of the project area has also likely occurred adjacent to Echo Creek, Birch Creek, Peterson Creek, and Patterson Creek. As a result of this past harvest history, there is a potential very low direct and indirect existing impact to the riparian function, large woody debris, and stream temperature habitat features for native or non-native fisheries in Krause Creek, Echo Creek, Birch Creek, Peterson Creek, Patterson Creek and Swan River.

There are likely no direct and indirect existing impacts to the riparian function, large woody debris, and stream temperature habitat features for native or non-native fisheries in Noisy Creek, lower Rocky Creek, Wolf Creek, and Bear Creek.

3.4.5 Habitat – Connectivity

Connectivity is the capability of different life stages (e.g. adult or juvenile fish) to move among the accessible habitats within the normally occupied stream segments. For example, a culvert or dam may reduce connectivity by preventing or impeding upstream or downstream adult or juvenile fish migration.

There is currently a bridge crossing of Krause Creek in the project area in SW1/4 NW1/4 T28N R19W Section 21. This road-stream crossing structure of Krause Creek provides full passage of all life stages of the non-native and native fish species.

On lower Rocky Creek in NW1/4 SE1/4 T27N R19W Section 3, there is an existing 36-inch round culvert that is a migration barrier to juvenile fish. Adult fish are able to migrate through the culvert during moderate to high flows. This road-stream crossing structure poses a low to moderate direct and indirect impact to fisheries in lower Rocky Creek.

One bridge and one culvert crossing on Birch Creek within the project have failed during high flow events. These two crossings of Birch Creek now provide full passage of all life stages of the non-native and native fish species.

There are currently two bridge crossings of Patterson Creek in the project area in SW1/4 T27N R19W Section 36. These two road-stream crossing structures of Patterson Creek provide full passage of all life stages of the non-native and native fish species.

Outside of the project area and on other land ownerships, there are potential existing impacts to connectivity as a result of road-stream culvert crossings on Krause Creek, Echo Creek, Noisy Creek, Wolf Creek, Bear Creek, Peterson Creek, and Patterson Creek. These road-stream crossings on other land ownerships constitute a potential existing low to high direct and indirect impact to fisheries connectivity on the specified streams.

There are no apparent direct or indirect existing impacts to the connectivity of fisheries in Birch Creek and the Swan River within the project area.

3.4.6 Existing Cumulative Impacts to Fisheries

Cumulative impacts are those collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (75-1-220, MCA). Future actions include state-sponsored actions that are under concurrent consideration by any state agency through environmental analysis or permit processing procedures. Existing cumulative effects to fisheries in the Foothills Timber Sale project area are determined by assessing the collective existing direct and indirect impacts, other related existing actions, and future actions affecting the fish-bearing streams in the project area. In order to help convey a summary of collective existing impacts, a matrix of existing effects to fisheries in the project area is displayed in Table 3-11.

Other related actions that are considered in the existing cumulative impacts are a low impact to Krause Creek due to off-road vehicle use and a low to moderate impact to the Swan River due recreational fishing and riparian harvest on other land ownerships in the project area.

Table 3-11: Matrix of collective existing effects and existing cumulative impacts to fisheries in the Foothills Timber Sale project area.

	Existing impacts to fisheries in the project area							
	Presence and Genetics	Flow Regimes	Sediment	Riparian Function, etc	Connect-ivity	Other Related Actions	Future Actions	**Existing Cumulative Effects**
Krause Creek	None	Very Low	Low/ Moderate	Very Low	Potential Low/High	Low	None Known	**Moderate**
Echo Creek	None	Very Low	Very Low	Very Low	Potential Low/High	None Known	None Known	**Low/ Moderate**
Noisy Creek	None	Very Low	Very Low	None	Potential Low/High	None Known	None Known	**Low/ Moderate**
Lower Rocky Creek	Moderate	Very Low	Low	None	None	None Known	None Known	**Moderate**
Birch Creek	Moderate	Very Low	Low/ Moderate	Very Low	None	None Known	None Known	**Moderate**
Wolf Creek	Moderate	Very Low	Very Low	None	Potential Low/High	None Known	None Known	**Low/ Moderate**
Bear Creek	Moderate	Very Low	Very Low	None	Potential Low/High	None Known	None Known	**Low/ Moderate**
Peterson Creek	Moderate/ High	Very Low	Very Low	Very Low	Potential Low/High	None Known	None Known	**Moderate/ High**
Patterson Creek	Moderate/ High	Very Low	Low	Very Low	Potential Low/High	None Known	None Known	**Moderate/ High**
Swan River	Moderate/ High	Very Low	Very Low	Very Low	None	Low/ Moderate	None Known	**Moderate/ High**

The determination of existing cumulative effects in this fisheries analysis is based on an assessment of all variables, but the variables are not weighted equally in making the determination. Impacts from non-native fish species and sedimentation tend to have a greater level of existing risk to fisheries than the existing impacts from flow regimes and riparian function. Impacts to connectivity are based on unknown road-stream crossings that are outside of the project area, and there is a degree of uncertainty to those potential direct and indirect effects to this variable. As a result of these considerations, determinations of moderate and high existing cumulative impacts are primarily a consequence of the overwhelming impact to native fish species from non-native fish species in conjunction with existing impacts to other habitat variables.

There is likely a low to moderate existing cumulative impact to fisheries in Echo Creek, Noisy Creek, Wolf Creek, and Bear Creek. There is likely a moderate existing cumulative impact to fisheries in Krause Creek, lower Rocky Creek, and Birch Creek. There is likely a moderate to high existing cumulative impact to fisheries in Peterson Creek, Patterson Creek, and the Swan River.

3.5 WILDLIFE

The discussion in this section pertains to wildlife species and their habitat in the existing environment.

During the initial scoping and subsequent newsletter comment period, the following issues were expressed regarding the effects of the proposed project:

- Timber harvests could reduce forested patch size and connectivity, thereby reducing habitat for species that use forest stands.
- Timber harvests and road construction/reconstruction might result in "rampant" use by off-road vehicles.
- Timber harvests and associated activities might affect black and grizzly bears, wolf, elk, lynx, big game, and other wildlife species that inhabit the project area.
- Timber harvests and associated activities might reduce habitat quality and security for wildlife and fish species, including grizzly bear, lynx, mountain lion, white-tailed deer, and other big game.
- Changes in road management might decrease grizzly bear and other wildlife security in important habitats.
- Timber harvests in the hemlock and grand fir stands might decrease plant and animal diversity.
- Timber harvests might result in large opening that are harmful to wildlife.
- Timber harvests and associated actions might sever travel corridors, some of which occur along stream courses.
- Timber harvests might increase forage, resulting in increased habitat quality for big game in an area with high damage concerns.
- Access management might reduce hunter access in an area where FWP is trying to reduce population by increasing harvests.
- Changes of access might affect grizzly bear mortality.
- Timber harvests in section 35 and along the Swan River might decrease habitat for wildlife, including eagles, fox, deer, wood ducks, grizzly bears, and wild turkeys.
- Diversity and abundance of wildlife species may diminish with changes in forest stand conditions from timber harvest activities. Wildlife species to consider should include: grizzly bear, Canada lynx, bald eagle, black bear, mountain lion, white-tailed deer, elk, osprey, wild turkey, wood ducks, and fox.
    - Note: The wildlife analysis considers the effects of each alternative on threatened, endangered, sensitive species, and big game species in a fine filter analysis, while general habitat conditions described in a coarse filter analysis are used to broadly analyze the effects of other more common native species such as black bears, mountain lions, ospreys, wild turkeys, wood ducks and foxes.
- Habitat quality and security for wildlife species inhabiting the area may be adversely affected by timber harvest activities and road management.
    - This issue is analyzed under the connectivity analysis in the coarse filter analysis, while road management effects are discussed under grizzly bear and big game analyses.
- Timber harvest activities may disrupt or sever grizzly bear and other wildlife travel corridors, especially along Patterson Creek and the Swan River.
    - The effects are analyzed under the connectivity and grizzly bear analysis.
- Increases in road densities as a result of harvest activities could result in increase in grizzly bear/ human encounters or grizzly bear mortality.
    - The effects are analyzed under the grizzly bear analysis.
- Openings created in tree canopy by timber harvest may harm wildlife habitat
    - This issue is analyzed under the semi-closed and closed canopy forested habitat and connectivity portions of the coarse filter analysis.
- Openings created in tree canopy by timber harvest may increase already high deer populations
    - The effects to big game area discussed in the big game section.

In addition to the above issues, the analyses below and in Chapter 4 discuss other environmental effects of the alternatives to the wildlife resource.

Analysis Area

This discussion occurs at 2 scales. The project area includes DNRC-managed lands (4,887 acres) within Sections 21, 27, 28, and 34 in T27N, R19W, and Section 1-3, 10, 11, 14, 23, 24, 35 and 36 in T28N, R19W. Full descriptions of the project area and proposed harvest units are presented in CHAPTER 2 – ALTERNATIVES (Figure 2-1 and 2-2). The second scale relates to the surrounding landscape for assessing cumulative effects. This scale varies according to the species being discussed. In this analysis, cumulative effects will be discussed qualitatively, with an explanation of how the lands within the project area fit into the surrounding habitats and what that means to the wildlife species in question. In the cumulative-effects analysis area, the project area and the effects are placed in a landscape context. If habitat does not exist in the project area or would not be modified by any alternative, species that use that habitat were dismissed from further analysis.

Analysis Methods

To assess the existing condition of the project area and the surrounding landscape, a variety of techniques were used. Field visits, scientific literature, data from the SLI and Montana Natural Heritage Program, aerial photography, consultations with other professionals, and professional judgment provided information for the following discussion and effects analysis. In the effects analysis, changes in the habitat quality and quantity from the existing conditions were evaluated and explained. Specialized methodologies are discussed under the species in which they apply.

Coarse Filter Assessment

DNRC recognizes that it is an impossible and unnecessary task to assess an affected environment or the effects of proposed actions on all wildlife species. We assume that if landscape patterns and processes similar to those that species adapted to are maintained, then the full complement of species will be maintained across the landscape (DNRC 1996). This “coarse filter” approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate “historic conditions” across a landscape. To compare present and historical conditions across the landscape, the analysis was conducted for the Foothills Project Area using SLI data (refer to VEGETATION ANALYSIS) and was compared to the historical assessment compiled for the Upper Flathead (M333B) Climatic Section (Losensky 1997).

3.5.1 Patch Size and Interior Habitats

Issue: Timber harvests could reduce forested patch size, increase edge, and reduce connectivity, thereby affecting wildlife species that use forested stands.

Species that are hesitant to cross broad expanses without forest cover, or those that depend upon interior forest conditions can be sensitive to the amount and spatial configuration of appropriate habitat. Therefore, patch size and juxtaposition can influence habitat quality and population dynamics for some species. Some species are adapted to thrive near patch edges, while others are adversely affected by the presence of edge or by the presence of other animals that prosper in edge habitats.

For this analysis, “semi-closed and closed canopy forested habitats” provided the basis for patch, interior-habitat, and edge-habitat analyses. Semi-closed and closed canopy forested habitats were defined as stands greater than 40 years old (pole- to sawtimber-sized stands) with an overstory canopy cover of 40 percent or more. Habitat that is not considered semi-closed or closed canopy forested habitat is referred to as open habitat (Table 3-12). Edge was defined as the contact zone between Semi-closed and closed canopy forested and open habitats. For this analysis, the first 300 feet of a patch was considered edge habitat. The remaining patch area inside of 300’ of a hard edge was considered interior semi-closed and closed canopy forested habitat. Presently, the project area is comprised of 9 patches primarily of semi-closed and closed canopy stands, with relatively little edge habitat. These conditions favor species that use interior semi-closed and closed canopy forested habitats.

Table 3-12. Percentage of open, forested, edge, and interior habitat found in the project area.

		Semi-closed and closed canopy forested habitat		
	Open Habitat	**Edge Habitat***	**Interior Habitat**	**Project Area**
Acres	835	1,580	2,472	4,887
Percentage	17.1%	32.3%	50.6%	100%

*When buffering for edge habitat, buffers were generated along ownership breaks to capture the potential effects from adjacent lands. Approximately 196 acres of edge habitat abuts National Forest Service forested lands.

3.5.2 Connectivity

Issue: Timber harvests and associated actions might sever travel corridors, some of which occur along stream courses

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross broad, non-forested expanses. Stands that are pole-sized or greater with crown closure greater than 40 percent can be important for providing travel cover for species that use semi-closed and closed canopy forested habitat, even though they may not necessarily provide for all necessary life requisites. The width of forested patches needed to provide connectivity is generally related to home range size of the species being considered (Peters 1983). Generally, the wider the width, the more species that could move through the corridor. For this analysis a minimum corridor width of 300 ft. consisting of pole to mature stands with $\geq$40% overstory crown closure is assumed to provide habitat connectivity for native species that use semi-closed and closed canopy forested habitat in western Montana.

Wildlife species tend to travel along streams, ridges, and cross hydrologic divides through saddles (Thomas 1979). The project area lies at the base of the Swan Mountain Range and then flattens out into the Flathead Valley. Numerous streams flow through the project area providing potential movement corridors for wildlife species. However, the base of the project area adjoins the human populated Flathead Valley. The populated valley bottom generally does not provide suitable habitat for many species. Where the valley bottom does provide habitat, the animals that inhabit that habitat could experience increased mortality risks due to conflicts with human developments. Along the streams and throughout most of the uplands, canopy cover exceeds 40%, resulting in high connectivity throughout the project area (Figure 3-6).

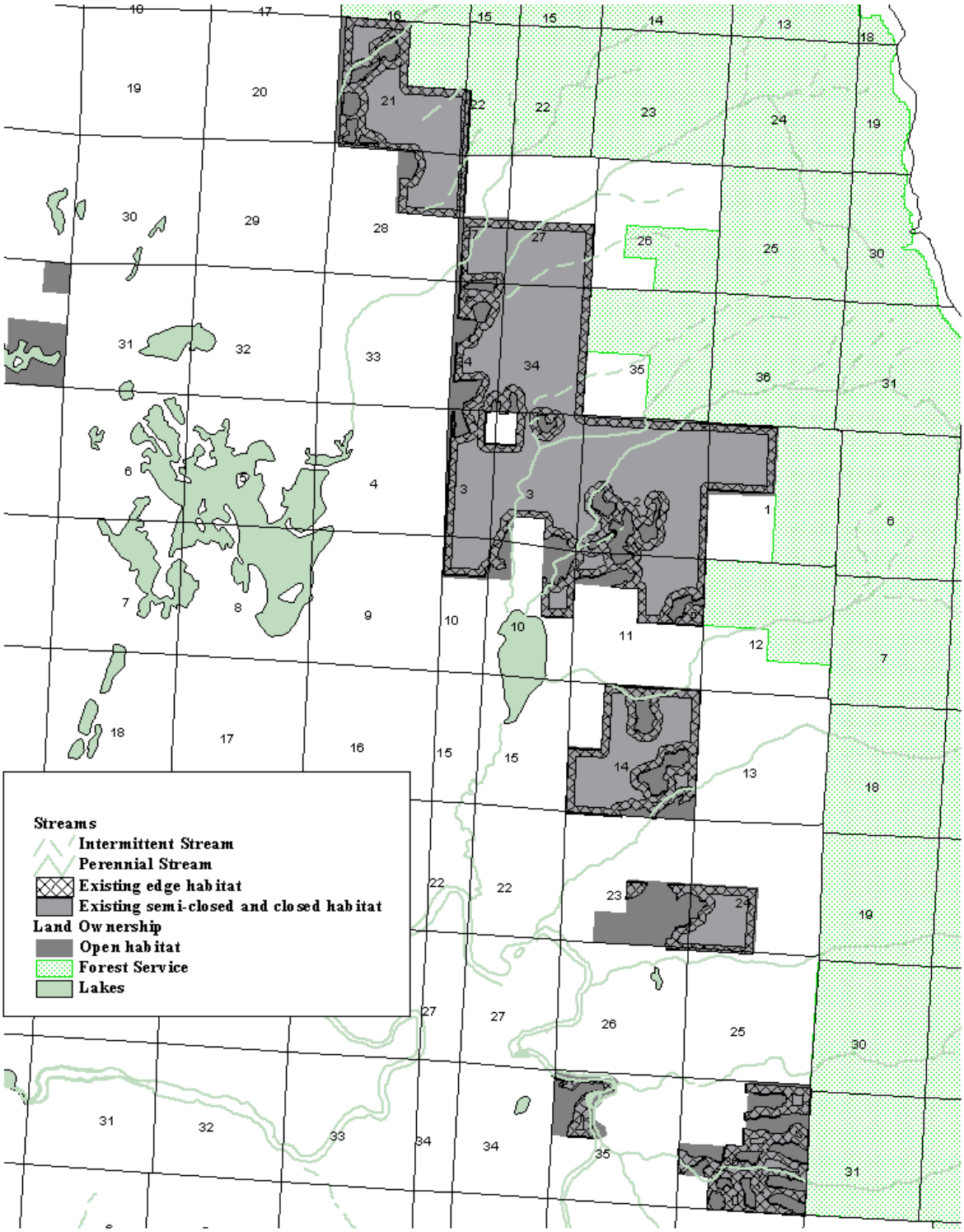


Figure 3-6. Existing semi-closed and closed canopy forested, interior, and edge habitat

3.5.3 Dead Wood Resources

Issue: Timber harvests would remove snags and downed wood that provide important habitat for wildlife species.

Snags and downed trees provide important components of forested ecosystems. Snags and downed wood provide structural diversity, alter canopy microenvironment, promote biological diversity, provide critical habitat for wildlife, and act as a storehouse for nutrient and organic matter recycling agents (Parks and Shaw 1996). This analysis focuses on the importance of dead wood as wildlife habitat and the effects of this project on those habitats.

The presence of wildlife species contributes to healthy, functioning forests. Mammals and birds provide many functions to forest ecosystems ranging from seed dispersion and "planting" to providing biological control of many forests insects that are harmful to wood production. Mammals, such as squirrel, chipmunks, bushy-tailed woodrats, distribute and "plant" conifer seeds. Additionally, many small mammals distribute ectomychorrhizal fungus, which is beneficial for seedling establishment and tree growth (Amaranthus 1998, Graham 1994). Birds also aid in seed dispersal and help control forest pests through predation, habitat modification (bark flaking), and providing avenues for disease transmission to forest pests that reduces survival (Ovtos 1979, Steeger et al. 1998). In 27 studies reviewed by Steeger et al (1998), 26 concluded that insectivorous birds substantially reduced bark beetle survival. Estimates from these studies indicated a reduction in insect populations from 2-98%. Koplin (1972) estimated that a single three-toed woodpecker could consume several thousand spruce beetle larvae per day. In addition to predation, some studies indicated that woodpeckers can contribute to bark beetle mortality indirectly by bark flaking, excavating, puncturing, or otherwise reducing the protection provided by the bark, thereby increasing parasite access to beetle broods (Otvos 1965) and altering the microclimate needed for survival (Moore 1972, Otvos 1979). In areas with high densities of insects, woodpecker populations can increase up to 7-fold during the breeding season and 85-fold during the winter. Downy, hairy, three-toed, and black-backed woodpeckers tend to be more apt than other species to congregate in these areas (Steeger et al. 1998). However, the ability of these species to congregate and reduce prey in such areas is dependent on maintenance of suitable habitats and populations over time. Some increased reproduction in response to insect outbreaks is expected, however, this situation creates a time lag between insect populations and the numerical response of their predators resulting in an increased chance of an epidemic. Maintenance of insectivorous bird populations over time delays onset of insect outbreaks, accelerates the decline following an outbreak, and increases the time span between outbreaks (Otvos 1979, Torgenson 1994, Steeger et al. 1998). Many of these birds and small mammals depend upon snags and downed logs for nesting, denning and foraging sites and thus, are indirectly important for maintenance of forest health.

The diameter, height, decay stage, and snag densities determine the structure available for wildlife species. Larger, taller snags tend to provide nesting sites, while smaller, shorter snags and stumps tend to provide feeding sites for birds. The density of snags of all sizes tends to correlate with the richness and abundance of birds (Dickerson et al. 1983, Scott 1979), a diversity of snag size classes are important for healthy forests. For coarse woody debris, large diameter logs of longer lengths tend to provide better habitat than smaller and/or shorter logs. Single scattered logs provide lookout and travel sites for squirrels or access under the snow for small mammals and pine martens, while log piles provide habitat for weasels, hares, and other small mammals. Under natural conditions, snags and logs tend to occur in patches across the landscape, with the occasional lone snag or log.

Snag densities were estimated using reconnaissance plots, field visits, and SLI data. In general, these data indicate that snag densities are higher than would be expected in unmanaged stands (Harris 1999). Where snag densities exceeded expected amounts, the additional snags occurred in the small and medium size class. This situation is expected in stands that show effects of fire suppression (Harris 1999). Overall, snag densities of large snags were lower than expected (Table 3-13). In harvest units that were not sampled, SLI data and subjective walk through assessments were made. Observations indicated similar results, as those sampled. Large snags throughout the area appear to be relatively low in density, which is expected in previously harvested stands (Harris 1999) and near open roads (Bate et al. 2002). Many of the snags present are grand fir. Previous harvests and firewood cutters removed

many of the shade-intolerant trees species snags. The current relatively unrestricted motorized access into the project area probably contributes to the loss of snags and downed trees.

Table 3-13. Comparison of expected snag densities and the estimates by harvest unit based on reconnaissance plots[1].

Harvest Unit	Total Snags/acre	8-15" Dbh Snags/acre	15-21" Dbh Snags/acre	Over 21" Dbh Snags/acre
Expected Densities (Harris 1999)	18.3	13.2	3.9	1.2
BL-1	91.7	--[2]	--	--
BL-2	34.2	21.9	12.3	0.0
BC-1	10.2	--	--	--
BC-2	25.9	14.6	10.5	0.7
BC-3	37.7	31.7	4.4	1.5
DC-1&2	41.7	33.5	8.3	0.0
K-4 & E-1	12.7	--	--	--
ML-1	7.9	2.8	4.4	0.7
JB1-A	20.7	13.1	7.8	0.0
JB-7&8	20.2	--	--	--
PC-1&2	65.0	--	--	--
PC-3	25.4	--	--	--

[1]The estimates based on the reconnaissance plots are coarse, based on small sample sizes, and incorporate large confidence intervals.
[2]Unavailable information; data collected could not be separated into these size classes.

Fine Filter Analysis

In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species federally listed as threatened or endangered, species listed as sensitive by DNRC (ARM 36.11.436(6)), and species managed as big game by DFWP. These species are addressed below.

Threatened and Endangered Species

3.5.4 Bald Eagle

Issue: Timber harvests could reduce habitat for bald eagles in the Ferndale and Echo Lake territories.

The bald eagle is classified as "threatened" and is protected under the Endangered Species Act. Strategies to protect the bald eagle are outlined in the Pacific States Bald Eagle Recovery Plan (USFWS 1986) and the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994). Management direction involves identifying and protecting nesting, feeding, perching, roosting, and wintering/migration areas (USFWS 1986, Montana Bald Eagle Working Group, 1991).

Bald eagles prefer multistoried nesting habitats with 40- to 70-percent canopy cover, with emergent trees within topographic line-of-sight to an associated water source with an adequate food supply. The emergent trees and/or snags need to be large enough (more than 25 inches dbh) to support nesting or perching eagles. Additionally, eagles prefer cottonwood, Douglas-fir, and ponderosa pine trees (Wright and Escano 1986). In western Montana, eagles also use western larch and Engelmann spruce.

The Ferndale and Echo Lake bald eagle territories include portions of the project area. These territories were defined by buffering the nest location by 2.5 miles (ARM 36.11.403(6)), resulting in a territory size of

12,560 acres for each territory. Approximately 1,017 and 695 acres of the project area are within the Ferndale or Echo Lake bald eagle territories, respectively. Habitat use in the project area is expected to be low due to the lack of foraging opportunities, except along the Swan River in section 35. The portion of this section that is adjacent to the Swan River could provide potential nesting habitat. However, at this time, no existing bald eagle nests or primary use areas occur within the project area.

To assess cumulative effects, the Ferndale and Echo Lake bald eagle territories were used. The nest sites for both territories occur on privately owned lands. Between the nest sites and the project area lie rural communities and State Highway 35.

3.5.5 Gray Wolf

Issue: Changes in road management and openings produced by timber harvests might decrease gray wolf security in important habitats.

The gray wolf is listed as "endangered" under the Endangered Species Act in some locations in the lower 48 states. The Northern Rocky Mountain Wolf Recovery Plan defines 3 recovery zones (USFWS 1987). The proposed project is in the Northwest Montana Recovery Zone where the wolf remains federally listed as endangered. Since 2000, the 3 recovery zones met the recovery objectives for the minimum number of breeding pairs (30 breeding pairs). In 2004, an estimated 66 breeding pairs were detected (USFWS et al. 2005). The de-listing process is underway and DFWP has assumed lead management authority over the species in Montana.

The wolf is a wide-ranging, mobile species. Adequate habitat for wolves consists of adequate prey and minimal human disturbance, especially at den and/or rendezvous sites. Primary prey species in northwest Montana are white-tailed deer, elk, moose, and mule deer. Wolves in northwest Montana typically den during late April in elevated areas with gentle terrain near a water source (valley bottoms), close to meadows or other openings, and near big game wintering areas.

Presently, no pack activity (USFWS et al. 2005) or radio-collared wolves (K. Lauden, FWP, 5/3/05, pers. comm.) have been documented in the project area. However, the project area provides habitat for white-tailed deer, elk, and mule deer throughout the year. White-tailed deer use is probably limited during winters with heavy snow accumulation (T. Litchfield, FWP, pers. comm.). The animals wintering and living in the project area could provide prey for wolves. However, human disturbance probably reduces the quality or likelihood of use of habitat found within the project area.

The composite big game winter range in Bear, Birch, Deer, Echo, Krause, Noisy, Patterson, Peterson, Rocky, and Wolf Creek watersheds was used to assess cumulative effects to gray wolves (Figure 3-7). This area is comprised of private (39.5%), USFS (39.5%), and DNRC (21.0%) managed lands.

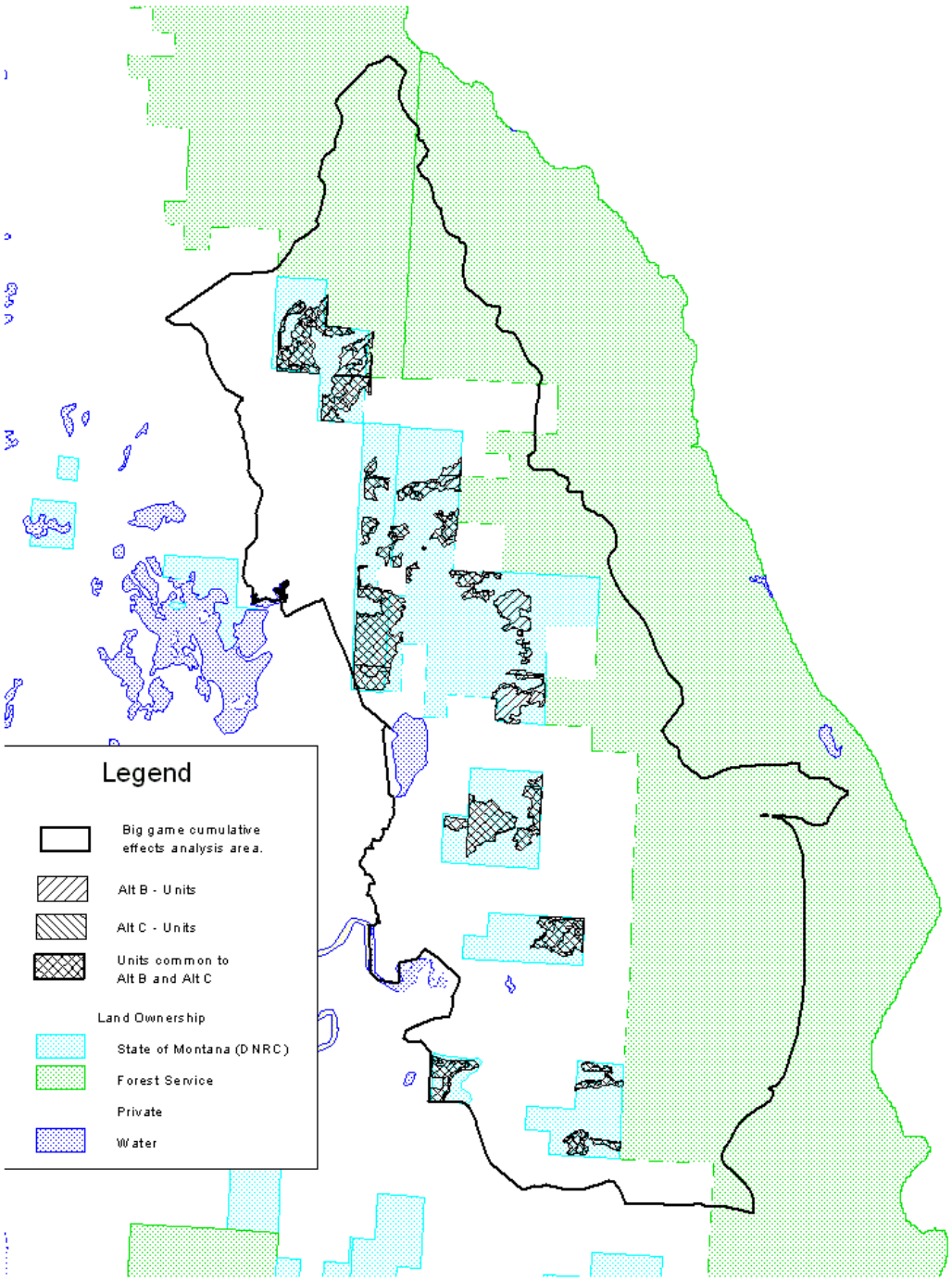


Figure 3-7. Gray wolf and big game cumulative effects analysis area.

3.5.6 Grizzly Bear

Issue: Changes of access and rampant illegal motorized use might decrease grizzly bear security and result in increased mortality.
Issue: Timber harvests and associated activities might reduce habitat quality and security and might result in large opening that are harmful to wildlife

Grizzly bears are listed as "threatened" under the Endangered Species Act. The Grizzly Bear Recovery Plan defines 6 recovery areas (USFWS 1993). This project is proposed in grizzly bear habitat in the Northern Continental Divide Ecosystem (NCDE) Recovery Area. The NCDE is divided into Bear Management Units, and further into Bear Management Unit Subunits. Each subunit approximates the size of a home range for a female bear and is separated from other subunits based on landscape features. DNRC uses the subunit level to analyze effects to grizzly bears. This project is proposed in the Noisy Red Owl and Peters Ridge Subunits.

During the spring, bears leave their dens in search of needed nutrition to recover from the denning period. At this time of the year, areas in the valley bottoms and southern and western aspects are starting to become snow free and vegetation is starting to greenup. These areas also tend to be on or near big game winter ranges that could offer additional food sources from winter-killed big game. Because most of the countryside is still snow covered, spring grizzly bear habitat availability is limited. When bears are using these limited areas, human disturbance can result in reduced foraging time, increased energetic expenditure, and/or human caused mortality. These effects could lower the probability of survival and/or reproduction of bears that use such areas.

The project area could be used throughout the year, but is primarily used during the spring and to a lesser degree, autumn periods (Cumulative Effects Model, unpubl. data, Manley, unpubl. data, T.Manley, pers. comm.). The project area contains many riparian areas that provide grizzly bear foods. In addition, a majority of the project area lies on relatively flat topography adjacent to rural residential development. The presence of rural development adjacent to important grizzly bear habitat represents a high-risk situation for bear habituation, conditioning to unnatural foods, and human-bear encounters that could lead to grizzly bear mortality. In addition, the areas that provide quality grizzly bear habitat (primarily spring) receive high recreational pressures and illegal motorized use. The high recreational use and the flat topography lead to high densities of motorized access throughout the project area. DNRC has been mostly unsuccessful in restricting motorized access in the project area. This situation leads to a conflict between grizzly bear security needs and illegal motorized uses in the area. Continued and presumably increasing motorized use could continue to affect grizzly bear habitat in the project area. In addition, the proposed project could further affect bears in the area through increased road traffic, noise, and human activity, and by altering the amount and location of hiding cover and forage resources.

Managing motorized access and other habitat components that provide security comprise the major factors in managing grizzly bear habitat in this project area. There are several open roads through the project area. Other roads in the area are restricted year-round with gates or berms. Many of these roads continue to receive illegal motorized use, despite DNRC's efforts to maintain the closure devises. Additionally, many illegal roads have been and continue to be pioneered in the project area. The relatively flat topography and lack of enforcement fail to discourage illegal use.

To measure disturbance associated with open roads, simple linear densities were used. Currently, 3.6 miles/sq. mile open road density (including highways and county roads) occurs on parcels included in the project area. However, disturbance attributable to motorized uses in the area may be much greater due to the rampant illegal motorized use of restricted roads. However, the level (number of trips per day average) of illegal road use by road system is unknown. If illegal use exceeds administrative use standards (ARM 36.11.403(53), then the linear open road density may approach approximately 8.7 miles/sq. mile. The only location that provides relatively undisturbed habitat is on steep slopes on the western portion of section 1. This area occurs in the uplands in the higher elevations of the project area, which probably offers less quality spring habitat. Better habitat exists in riparian communities found in the flatter terrain of the project area, where DNRC has been minimally successful in controlling motorized access. By ARM 36.11.433 (1)(a), DNRC is directed to design projects not to increase linear open road density on DNRC lands in the project area, and reduce total road density where compatible with other

agency goals and objectives. Managing motorized access reduces the potential for mortality, displacement from important habitats, habituation to humans, and provides relatively secure habitat where energetic requirements can be met (IGBC 1998).

The cumulative effects were qualitatively analyzed at the scale of the Noisy Red Owl and Peters Ridge Subunits. DNRC ownership comprises 14.7% of the Noisy Red Owl Subunit and 2.8% of the Peters Ridge Subunit. However, this relatively low amount of landownership occurs in key areas. This subunit receives a high amount of recreational use, which varies by season and includes snowmobiling, cross-country skiing, ATV riding, firewood cutting, etc. Additionally, the lower elevations contain rural residential developments.

Sensitive Species

When conducting forest-management activities, the Forest Management Rules direct DNRC to give special consideration to several "sensitive" species. These species are sensitive to human activities, have special habitat requirements that may be altered by timber management, or may become listed under the Endangered Species Act if management activities result in continued adverse impacts. Because sensitive species usually have specific habitat requirements, consideration of their needs serves as a useful "fine filter" for ensuring that the primary goal of maintaining healthy and diverse forests is met. The following sensitive species are known to occur within the administrative boundaries of the NWLO and were considered for analysis. As shown in Table 3-14, each sensitive species was either included in the following analysis or was dropped from further analysis for stated reasons.

Table 3-14. Listed sensitive species for the Northwest Land Office indicating habitat presence or absence for these species in relation to this project.

Species	Determination - Basis
Black-backed woodpecker	No further analysis conducted – No burned habitat occurs in the project area.
Coeur d'Alene Salamander	No further analysis conducted – no moist talus or streamside talus habitat occurs in the project area.
Columbian sharp-tailed grouse	No further analysis conducted – no suitable grassland communities occur in the project area.
Common loon	No further analysis conducted – No suitable lakes exist in the project area.
Fisher	**Included** – potential fisher habitat occurs in the project area.
Flammulated owl	No further analysis conducted – No dry ponderosa pine habitats occur in the project area.
Harlequin duck	No further analysis conducted – No suitable creeks occur in the project area.
Northern bog lemming	No further analysis conducted – no sphagnum bogs or other fen/moss mats occur in the area.
Peregrine falcon	No further analysis conducted – no cliffs suitable for nesting occure in or near the project area.
Pileated woodpecker	**Included** – western larch/Douglas fir and mixed conifer habitats occur in the area.
Townsend's big-eared bat	No further analysis conducted – no caves or mine tunnels occur in the project area.

3.5.7 Fisher

Issue: Timber harvests could reduce habitat quality, quantity, and fragmentation of habitats used by fishers.

Due to their predominant use of mature and late-successional semi-closed and closed canopy forested habitats, fishers are listed by DNRC as a sensitive species (DNRC 1996). DNRC's strategy to conserve fishers in a managed landscape is primarily aimed at protecting valuable resting habitat near riparian areas and maintaining travel corridors.

Fishers are generalist predators and use a variety of habitat types, but are disproportionately found in stands with dense overhead canopy (Powell 1982, Johnson 1984). Fishers appear to be highly selective of resting and denning sites. In the Rocky Mountains, fishers appear to prefer late-successional coniferous forests for resting sites and use riparian areas disproportionately to their availability. Fishers tend to use areas within 155 feet of water. Such areas often contain large live trees, snags, and logs, which are used for resting and denning sites, and dense canopy cover which is important for snow interception (Jones 1991).

No fisher use has been detected in the project, but field reconnaissance indicates that all the harvest units provide potential fisher habitat. Fishers tend to use mesic forest habitat type both in the uplands and in riparian areas (Jones1991) with canopy cover of 40% or greater (Jones 1991, Buck 1982). Based on cover type and canopy closure, a minimum of approximately 4,052 acres (82.9%) of potential fisher habitat exists in the project area. Regenerating stands of dense trees or shrubs could offer additional fisher habitat. However, throughout the project area, large snags and downed wood are uncommon reducing the quality of potential fisher habitat. Within the project area, approximately 89.6% of the area within 100' of a class 1 and 50' of a class 2 stream are in a moderate or well stocked sawtimber class [ARM 36.11.440(1)(b)(i)].

For cumulative effects, travel and connectivity to adjacent habitat on other ownerships was considered within the Bear, Birch, Deer, Echo, Krause, Noisy, Patterson, Peterson, Rocky, and Wolf Creek watersheds (Figure 3-8). In the cumulative effects analysis area, State trust lands and the USFS lands above the project area provide potential denning/resting, foraging, and travel habitat. However, private lands below the project area probably provide little habitat. Currently, these areas are highly connected, thereby allowing fishers to use and move relatively unimpeded between the project area and habitats on adjacent lands. However, firewood cutting and past harvests probably reduces important snag and coarse woody debris in the project and adjacent areas.

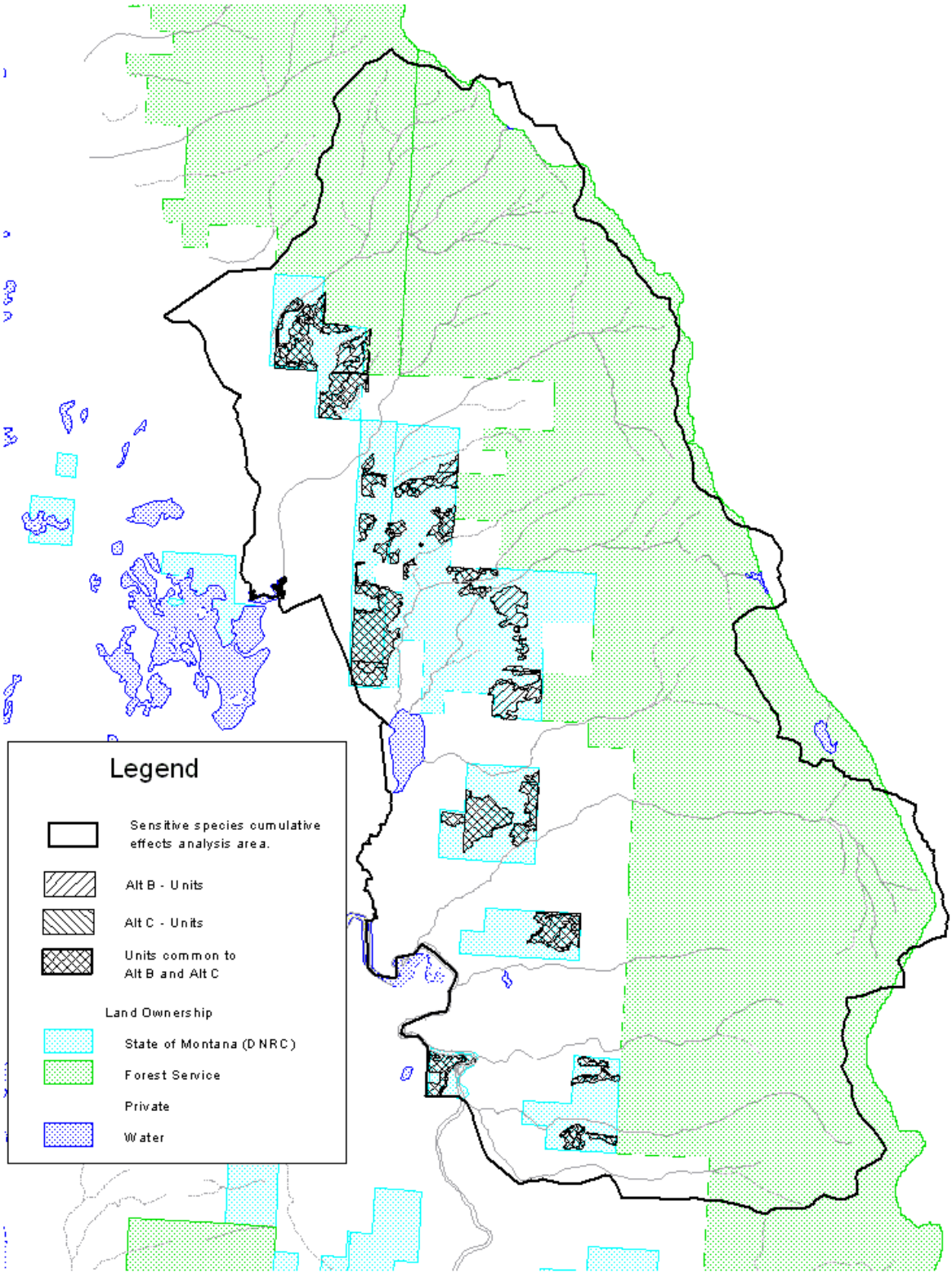


Figure 3-8. Fisher and pileated woodpecker cumulative effects analysis area.

3.5.8 Pileated Woodpecker

Issue: Timber harvests could reduce potential pileated woodpecker habitat.

Pileated woodpeckers are listed by DNRC as sensitive and play an important ecological role by excavating cavities that are used in subsequent years by many other species of birds and mammals. Pileated woodpeckers excavate the largest cavities of any woodpecker. Preferred nest trees are western larch, ponderosa pine, cottonwood, and quaking aspen, usually 20 inches dbh and larger. Pileated woodpeckers primarily eat carpenter ants, which inhabit large downed logs, stumps, and snags. Aney and McClelland (1985) described pileated nesting habitat as "stands of 50 to 100 contiguous acres, generally below 5,000 feet in elevation with basal areas of 100 to 125 square feet per acre and a relatively closed canopy." The feeding and nesting habitat requirements, including large snags or decayed trees for nesting and downed wood for feeding, closely tie these woodpeckers to mature forests with late-successional characteristics. The density of pileated woodpeckers is positively correlated with the amount of dead and/or dying wood in a stand (McClelland 1979).

Potential pileated woodpecker nesting habitat was identified by searching the SLI database for 100+ year old stands with more than 40 percent canopy cover, and below 5,000 feet in elevation. Based on SLI data, approximately 2,418 acres of the project area offers pileated woodpecker nesting habitat (Figure 3-9). Nesting habitat on these acres is likely of marginal quality due to lack of large shade-intolerant tree species. The remaining 1,764 acres of semi-closed and closed canopy forested habitat could offer potential foraging habitat if prey species, like carpenter ants, are present. For this analysis, semi-closed and closed canopy forested habitat as defined in 3.5.2 that did not meet the nesting criteria above, where assumed to provide foraging habitat. Due to illegal motorized access and firewood cutting, large snags continue to be removed from stands near open and illegally accessed roads.

The cumulative effects analysis will generally consider how this project area fits into the surrounding landscape and what effects that would have on pileated woodpeckers within the Bear, Birch, Deer, Echo, Krause, Noisy, Patterson, Peterson, Rocky, and Wolf Creek watersheds (Figure 3-8). The private lands adjacent to the project area continue to face rural residential development. Additionally, firewood gathering and illegal motorized use could be influencing the production of suitable nesting snags on USFS surrounding the project area.

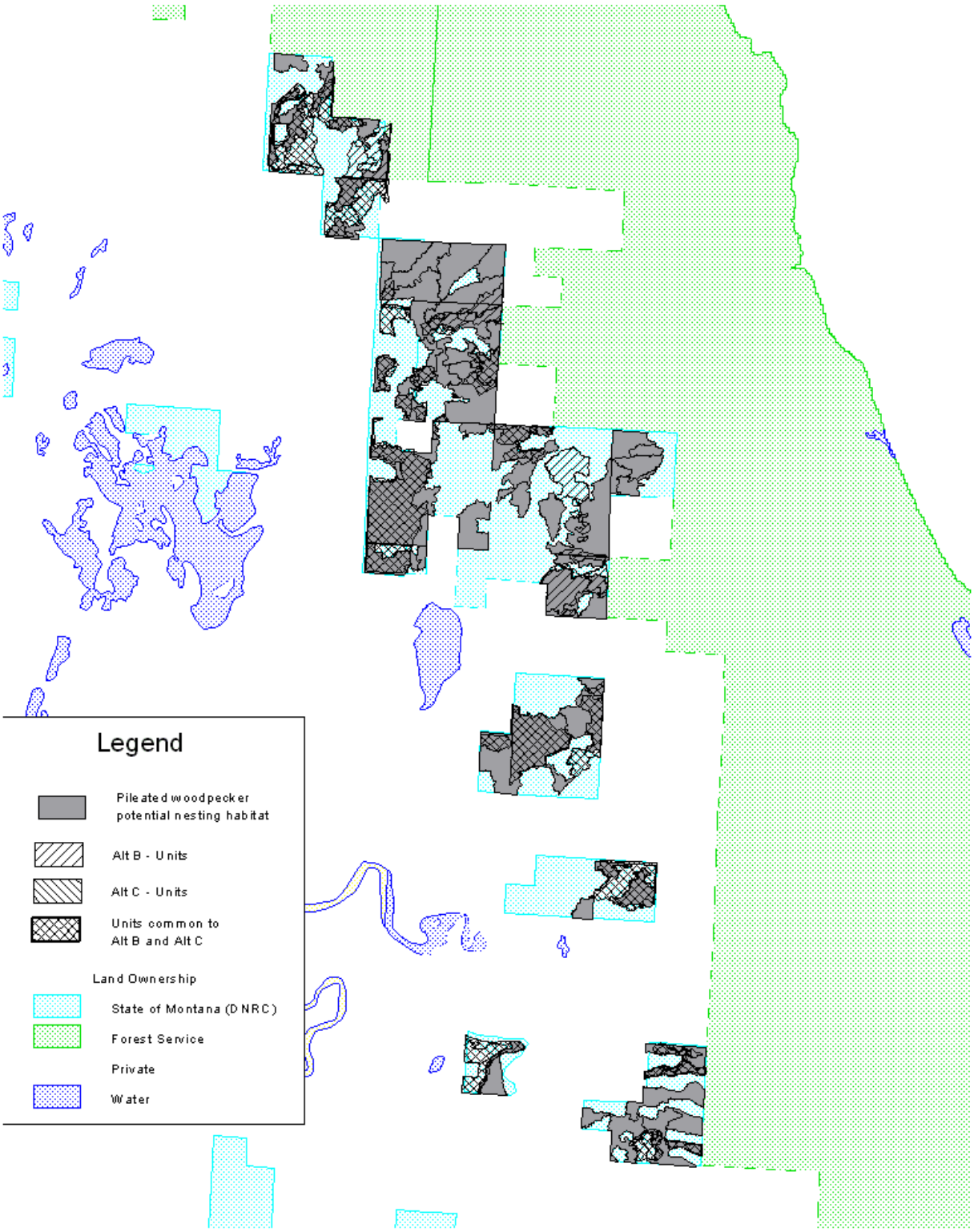


Figure 3-9. Potential Pileated Woodpecker Nesting Habitat Existing in the Project Area.

3.5.9 Big Game Species

Issue: Timber harvests and associated activities might change habitat quality and security for big game species.

Issue: Access management might reduce hunter access in an area where FWP is trying to reduce big game populations by increasing harvests.

The project area provides winter range for white-tailed deer (FWP 1996), mule deer (FWP 2004), and elk (FWP 1999). Additionally, these species inhabit the project area year-round. However, in winters with average or more than average snow accumulations, white-tailed deer use during the winter is expected to be low (T. Litchfield, FWP, pers. comm. 4/19/05). In these types of winters, elk and mule deer are expected to continue to use the project area in the winter.

Big game habitat is comprised of forage, hiding cover, and thermal cover. Forage provides for the nutritional requirements of the animals in question. Hiding cover serves to reduce vulnerability to predators and humans, while thermal cover reduces heat loss of animals to the environment and provides snow interception, which allows movement of big game and access to forage during the winter period. To be considered hiding cover, vegetation must conceal approximately 90% of an animal at 200 feet (Thomas 1979). Thermal cover is defined as greater than 70% canopy closure at or above 40 feet (Thomas 1979). Areas with canopy cover between 40-70% provide some level of snow interception (albeit less than stands that meet the thermal cover definition) that is beneficial to big game habitat. These semi-closed canopy forested habitat reduce snow accumulations, which allows greater ease of movement and access to forage when compared “open stands” as defined in section 3,5,2 above. For this analysis, stands meeting these criteria provide some level of snow intercept in relation to their canopy closure were referred to as semi-closed canopy forested stands.

Forage requirements vary by species. In western Montana, deer tend to be browsers in winter, primarily, that rely on conifers and shrubs for forage, while elk tend to be grazers that rely more on grasses and sedges. However, deer consume herbaceous material and elk consume browse during different times of the year. Additionally, each species requirement for cover differs. Elk and mule deer tend to tolerate deeper snow depths than white-tailed deer, therefore elk and mule deer can tolerate less snow interception on their winter range then white-tailed deer.

Currently, most of the project area provides hiding cover, while 4,197 acres (86%) provide thermal cover, 90 acres (2%) provide semi-closed canopy stands, and open stands (most with hiding cover) make up the remaining 615 acres (13%) of the project area. The combination of hiding cover and restricting motorized access serve to lower big game vulnerability. Motorized use likely results in avoidance of habitat and lower security to big game in the project area.

For cumulative effects, the composite white-tailed deer, mule deer, and elk winter range within the Bear, Birch, Deer, Echo, Krause, Noisy, Patterson, Peterson, Rocky, and Wolf Creek watersheds were used (Figure 3-7). This area is comprised of private (39.5%), USFS (39.5%), and DNRC (21.0%) managed lands. In the lower elevations of this composite area is comprised of rural residential development and provides marginal habitat, while the areas above the project area generally do not provide winter range.

3.6 AIR QUALITY

Road dust created from hauling logs across native surface or gravel roads may affect air quality. Air quality could be affected by smoke produced from burning slash created from timber harvesting and related activities.

Air quality for the project area is considered good. Currently, the project area contributes very low levels of air pollution into the analysis area or local population centers. Temporary (and very localized) reductions to air quality within the project area occur in the summer and fall. These reductions are due mostly to road dust generated by residential and recreational traffic on gravel or native surface, open, public roads, and occasionally from smoke produced from burning slash piles. None of the air-quality reductions affect local population centers at levels beyond EPA standards. All burning activities conducted by primary local entities that burn (which includes DNRC, USFS, and Stoltze Lumber) comply with emission levels authorized by the Montana Airshed Group. The project area is outside any of the local impact zones, where additional restrictions may be imposed to protect air quality, however, numerous parcels adjacent to trust lands are occupied by year round residents or seasonal residents.

3.7 AESTHETICS

The Foothills Timber Sale project area is very visible to the general public due to the area's proximity to the urban interface. County roads and other roads open to the public pass through or provide good views into the majority of the project area. Most of the project area has relatively flat topography and does not provide landscape type views from roads. The lands located along the Strawberry Lake Road and Krause Creek are located on south to southwest facing sideslopes and would provide more of a landscape view from open roads. The issue was raised that forests management activities may affect aesthetics in the project area, in regards to visual scenery, quiet, and proximity to wilderness.

The project analysis area includes all School Trust lands within the Foothills Timber Sale project area and the roads on state land that would be used to access harvest units.

The majority of the Foothills project area is viewed from open roads. Views consist of dense forest stands and past harvesting activity. Views are limited to about 200 feet into dense stands of overstory trees. Views into stands that have been harvested in the past 15 to 20 years generally provide views of dense regeneration and are limited to 100 feet or less. Some of these stands have been pre-commercially thinned and site distance is increased slightly.

3.8 RECREATION

The Foothills Timber Sale project area currently experiences recreational use by the general public throughout the year. More recently special recreational use licenses have been permitted for concentrated (group) use of trust lands in the north half of the project area. Issues expressed by the public and internally are:

- Timber harvesting and associated logging road management may result in fewer miles of road suitable for general or special recreational uses typically occurring in the Foothills area, such as biking (motorized & non-motorized bikes and ATV's), hiking, snowmobiling, skiing, and hunting.
- Skid trails and roads associated with timber management activities in conjunction with more open timber stands may increase the number of violations of recreational use rules for state trust land.

Analysis Methods

Methods used to describe the existing condition and determine recreational impacts of the project include determining recreational uses and approximate revenue, and potential conflict between project activities and recreational uses. State Trust Lands that are legally accessible and have not been closed or restricted by rule or DNRC to recreational use are open to recreational use. Recreational use of Trust Lands is divided into three categories:

- General Recreational Use: trust lands are available for mostly nonmotorized recreational activities such as hiking, biking, skiing, snowmobiling, and horseback riding to anyone purchasing a General Recreational Use License for State Lands.
- Montana Conservation License Holders: persons possessing valid licenses from DFWP are authorized to engage in hunting or fishing activities on state trust lands open to recreational use.

- Special Recreational Use: under site specific licenses purchased from DNRC commercial or concentrated (group) recreational use may be permitted on trust lands

Analysis Area

The analysis area includes all legally accessible lands within the Foothills Timber Sale project area and the roads on state land that would be used to access harvest units.

Existing Condition

The Foothills project area is used primarily for general recreational use and hunting. All trust lands in the project area have at least one point of entry for recreational use from open public roads. The Bear Creek County Road, Strawberry Lake and Jewel Basin Roads traverse trust lands and are primary routes for accessing the Flathead National Forest Jewel Basin Hiking Area immediately east of the project area. Several undeveloped parking areas are present along the Jewel Basin Road and the Foothills County Road. Revenue generated for state trusts from general recreational use licenses varies by fiscal year and is generated on a statewide basis. In 2004 the total gross revenue from General Recreational Use Licenses was $801,980, from approximately 5.1 million acres of trust land (DNRC, 2004). Average gross revenue per acre, calculated from the figures above is approximately $0.15/acre or approximately $723 per year for the 4,816-acre Foothills Project Area.

Most roads on state land that junction with Strawberry Lake or Jewel Basin Road are closed, however, unauthorized uses such as riding All Terrain Vehicles (ATV's), 4 X 4 vehicles, and motorcycles on old skid trails and roads behind closures is a common occurrence. Vandalism associated with unauthorized recreational use in the form of: littering, destruction or breaching road closures; damaging trees by shooting, cutting, driving over, pulling out; and opening up old skid trails and roads or pioneering new trails has resulted in resource damage on several sites within the project area. Evidence of unauthorized use and vandalism has been more frequently observed in the last several years. This may be partly explained by increased use and relatively easy access to the Foothills project area in combination with the project area's proximity to local population centers, an increasing number of adjacent private landowners, a recently implemented hunting season for wild turkeys, and dependence on external enforcement of DNRC recreational use rules.

In 2002, the USFS purchased an easement ($3900) for two non -motorized trails originating from the Strawberry Lake Road and contouring across the east half of Section 2 to the Jewel Basin Hiking Area. These trails were pre –existing and are maintained by the USFS. These trails are open for use year round.

An annual special use license for cross-country skiing was issued to a local club for the winter seasons of 2003-04 and 2004-05, with an indication that an annual renewal or longer-term license is desired. Rental fees for these licenses contributed $2765.37 in trust revenue. This group uses skid trails and roads in Sections 27, 34, & 3 to provide groomed ski trails for ski club members and the general public. Based on observations of vehicles parked near groomed trail entry points, cross country skiing increased in this area during favorable snow conditions, as a result of this license. Trail grooming was hindered by 4x4 trespass during active grooming and prior to grooming. Segments of designated ski trails that are severely rutted or have deep mud holes affected trail grooming efficiency or effectiveness or required blading of the road surface prior to use. These problems were resolved by the ski club – placing signage and maps of designated groomed trails; designating short trail segments for both motorized and non-motorized use; and hiring road surface work to be completed prior to snowfall.

3.9 ECONOMICS

The issue was raised that each of the alternatives may affect revenue to the trust, local employment and income, and other uses of the area. The Foothills Project Area is located at the foot of the Swan Mountains approximately 13 miles east of Kalispell in Flathead County. The character of the sale area is rural, however there is a substantial amount of housing that caters to people wishing to avoid the more developed urban environment found in the Kalispell area. The population density of the area is still relatively low. The last large timber sale was harvested from the area as recently as the early 1990's.

The focus of the economics section of the EIS will be on market activities that directly or indirectly benefit the Montana education system, generate revenue for the School Trust Fund and provide funding for public buildings. Secondary benefits that profit the non-school general public will also be discussed.

Flathead and Missoula Counties have historically provided both manufacturing and recreational pursuits. Manufacturing has historically focused on mining and timber as well as a limited amount of agriculture processing. Recreation has focused on Glacier National Park as well as the many lakes and mountains in the region. Mining has declined within the area in recent years, and while timber has remained comparatively steady or declined slightly. In order to maintain the current level of industry activity, the decreased timber harvest from federal public lands had to be replaced from private timber sources.

The location of the Foothills Timber Sale in relation to purchasers likely to be interested buying timber from the sale, necessitates analyzing economic and demographic data for both Flathead and Missoula counties, although there is a potential from purchasers from further west of Flathead County being interested in this sale. Table 3-15 contains selected demographic information for each of these counties and for the entire state.

Table 3-15
Selected Demographic Information
Flathead and Missoula Counties

Demographic	Flathead	Missoula	Montana
Population 1990	59,218	78,687	799,065
Population 2000	74,471	95,802	902,195
Current Population	81,217	99,108	926,865
Growth Rate ('90-'00)	2.4%	2.0%	1.2%
School Enrolment	13,000	13,313	157,560
Source: Montana Department of Labor and Industry			

Flathead County is known for its production of "Flathead Cherries". Flathead County also has a large wood products sector producing a variety of products including dimensional lumber, plywood, and molding. In addition to wood products, Flathead County also has a large recreation industry that includes the primary entrance to Glacier National Park and Big Mountain a large and major ski destination. Missoula County is located south of Flathead County and contains several large mills that are likely to be interested in purchasing timber from this sale. Historically both mining and wood manufacturing played a large role in the counties economic activities. In recent years mining has declined in the region and timber has remained as one of the primary employers. The abundance of forests, lakes/streams, and wildlife provide an environment that attracts a large number of recreationists to the area. K-12 school enrollment in each of the counties is over 13,000.

The data in Table 3-16 shows employment and income in selected industry categories for each of the counties that are included in the analysis. Economic activity within the two counties varies substantially, although both counties have substantial timber related industry present. Missoula County is more populated and has a somewhat more diverse economic base than Flathead County. In addition the University of Montana has provided a consistent long-term payroll and employment resource independent base for the Missoula community to build on.

Table 3-16
Covered Wages and Employment 2004
Selected Industries – Flathead and Missoula Counties

	Flathead County			Missoula County		
Industry	Avg. Ann. Employment	Annual Wages(000)	Average Wage	Avg. Ann. Employment	Annual Wages(000)	Average Wage
Ag., Forestry and Fish	382	$14,627	$38,291	408	$13,019	$31,936
Forestry	250	10,045	40,180	249	8,019	32,164
Construction	3,090	97,117	31,429	3,064	96,896	31,622
Manufacturing	3,086	119,018	38,056	2,831	109,047	38,514
Wood products	1,517	64,136	42,278	923	33,536	36,318
Metals	330	13,241	40,124	58	1,896	32,450

Transportation	684	19,569	28,610	1,751	55,322	31,600
Trade	6,401	148,736	23,236	10,026	205,965	20,543
Eating & drink establishments	1,036	20,269	19,565	903	16,460	18,220
Fin., Ins., & R.E.	2,173	76,451	35,182	2,353	78,382	33,312
Services	14,390	310,457	21,574	21,992	538,233	24,474
Hotels etc.	1,235	20,341	16,470	1,045	13,068	12,506
Amus. & Rec.	949	12,769	13,455	1,067	12,869	12,066
Government	4,482	149,636	33,386	8,452	306,456	36,260
Total all Industries	35,707	$974,651	$27,296	52,212	$1,492,033	$28,576
Source: Montana Department of Labor and Industry, Research and Analysis Bureau						

Missoula County has a 46% larger labor force than Flathead County with nearly 600 more workers employed in the wood products sector. The average timber industry wage is 53% higher than the overall average wage in Flathead County and 24% higher than the overall average wage in Missoula County. Service industry wages are lower than the overall average wage in both counties, however, the service industries provide employment for over eighteen times as many workers as the timber industry Missoula County and over eight times as many workers as the timber industry in Flathead County. The average wage in the service industry is almost one-half of the average wage in the timber industry in Flathead County and about 70% of the average wage in Missoula County.

Broader market and local stumpage prices are currently above the long-term average. These prices are highly dependent on the housing market and foreign timber imports. The housing market is highly dependent on the interest rate which in part, determines who can "qualify" to purchase a home. Interest rates are currently at very low levels, have been low for several years and are one of the primary causes of the strong sustained housing market the US has been experiencing. These low interest rates impact the housing market by stimulating new construction to satisfy the demand for housing from larger than average number of individuals who can now "qualify" to purchase a home. The growth of the economy appears to be increasing, although the full recovery from the declines experience after the destruction of the World Trade Market is occurring more slowly than some analysts had expected. The result of the growth and low interest rates has been a continued strong housing market. Mortgage interest rates appear to be remaining at low levels despite the increases in the discount rate by the Federal Reserve. This should continue the strong demand for housing.

Restricted imports of timber and sheet goods from other countries, primarily Canada have helped bolster prices by reducing the supply of timber available to homebuilders. Recently, the U.S. trade issues that kept Canadian lumber out of U.S. markets were resolved. This has resulted in an increase in Canadian timber imports into the U.S. that has resulted in a softening of U.S. timber prices. In addition, the demand for US timber has increase due to a combination of economic recovery in several countries and the devaluation of the US dollar that makes our timber relatively cheaper to foreign buyers. The dollar devaluation makes Canadian exports to the U. S. more expensive which has also helped to keep U.S. price high. However, the devaluation of the dollar has slowed recently and is expected to have a reduced impact on price in the future. The timber prices used in the "effects" analysis attempt to recognize the current market conditions.

CHAPTER 4: ENVIRONMENTAL EFFECTS

INTRODUCTION

Chapter 4 describes the environmental effects of each alternative on the resources described in Chapter 3 and provides the basis for the Summary of Environmental Effects in Chapter 2. Cumulative effects from current management and foreseeable future State actions are discussed in this chapter. These include other active timber sales, those in the planning stage, ongoing maintenance, and other uses of the areas being analyzed. Direct, indirect and cumulative effects on the resources being analyzed were considered. Chapter 2 describes the details of each alternative and lists proposed mitigation measures specific to all action alternatives.

4.1 PREDICTED EFFECTS ON VEGETATION

4.1.1 Forest Age Class & Cover Type Distribution

No Action Alternative A – Direct Effects to Age Class and Cover Type Distribution
Under this alternative natural processes would continue to have a direct influence on these forest characteristics. In the absence of wildfires, the effects of current insect infestations and white pine blister rust induced mortality will continue to influence both short and long term age class distribution and cover type representation. It is estimated that 10% or more of the stands in the project area may drop into the next younger age class over the next few years, as older grand fir in the upper canopy levels succumbs to bark beetle attacks. Western white pine in upper canopy levels is diminishing annually due to white pine blister rust, therefore the shift from WWP cover types to MC cover types would continue. The conversion of WL/DF cover types to MC cover types is expected to progress at a much slower rate, as these species are generally long-lived and are experiencing endemic levels of mortality from insects or disease.

No Action Alternative A – Indirect Effects to Age Class and Cover Type Distribution
Openings created in the canopy from bark beetle mortality in grand fir dominated stands are not expected to resemble stand replacement fire effects. Openings are likely to be smaller and many may continue to be stocked with younger pole-sized trees. Without duff reduction and soil exposure the regeneration of openings is expected to favor shade tolerant species over seral species. The lack of regeneration under denser canopies or the predominance of grand fir in numerous understories would perpetuate the trend of increasing MC cover types over much of the project area. Without fire, the older age classes from 40 years up would continue to dominant the area and the 0-39 age class would continue to decline, as several 20 to 25 year old stands move into the next age class without replacement.

No Action Alternative A – Cumulative Effects to Age Class and Cover Type Distribution
Under the No Action Alternative the over representation of MC cover types would continue to increase within the project area and the Kalispell Landscape, at the expense of declining acreage in WWP and WL/DF cover types. The Foothills project area includes 82% of the WWP appropriate cover type acres for the Kalispell Landscape and provides the greatest opportunity for moving towards more historic representation of this cover type for Kalispell. This alternative would continue the decline of western white pine cover types within its ecological range, as well as the Kalispell Landscape. Like western hemlock its presence is dependent upon areas with a maritime influenced climate, which don't occur broadly across the Kalispell Landscape. It's limited ecological range, coupled with the effects of white pine blister rust, thus limit opportunities of increasing this cover type to those areas that would otherwise support it. Across the landscape, fire suppression, insect and disease occurrence, and increasing human use may influence cover type and age class distribution to an unknown degree. In the absence of stand replacement fires, variability of age class and cover type distribution would decline.

Alternatives B and C – Common Direct Effects to Age Class and Cover Type Distribution
As a result of harvesting, site preparation and tree planting activities, cover types would change or persist within the harvest units. By removing shade tolerant species (mostly grand fir) and retaining seral species and white pine, WWP and WL/DF cover types would persist for a longer time, or MC cover types would be converted to the more appropriate WWP or WL/DF cover type. The average age of all treated stands combined would decrease, although some stands would remain in the same age class after

harvest, depending on the extent of overstory tree removal. Units proposed for clearcutting, seedtree cutting, or overstory removal would move to the youngest age class such as occurs with a stand replacement fire event. The degree of change would be dependent upon the alternative implemented. Refer to Table 4-1and 4-2 for predicted changes in cover type and age class distribution by action alternative. Both actions would increase the diversity of stand age classes and cover types in the Foothills project area.

Table 4-1: Effects to Cover Type by Action Alternative

Cover Type	Current Cover Type (Acres)	Alt B after harvest Cover Type (Acres)	Alt C after harvest Cover Type (acres)	Appropriate Cover Type (Acres)
SAF	0	0	0	0
DF	40.5	40.5	40.5	39
HW	284.4	284.4	284.4	34.7
LP	252	252	252	49.8
MC	3526.4	2278.7	2570.2	1087.3
PP	145	145	145	173.7
OTHER	82.6	82.6	82.6	82.6
WL/DF	201.8	564.4	474.4	714.8
WWP	283.3	1168.4	966.9	2634.1
TOTAL	4816	4816	4816	4816

SAF = Subalpine fir. DF = Douglas-fir. LP = Lodgepole pine. MC = Mixed conifer. PP = Ponderosa pine. WL/DF = Western larch/ Douglas-fir. WWP = Western white pine. Other = non stocked lands or nonforest. The Current Type minus Appropriate Type column above lists the excess and deficit (-) acres for each Cover Type.

Alternative B – Direct Effects to Age Class and Cover Type Distribution

This alternative would harvest 1468 acres. Regeneration harvests, consisting of clearcut, seedtree, or shelterwood would occur on 843 acres, and intermediate harvests, consisting of improvement cutting, commercial thin, or overstory removal would occur on 625 acres. In the intermediate cuts, much of the grand fir would be removed favoring the retention of western larch, western white pine, ponderosa pine (trace), Douglas-fir, lodgepole pine, spruce, western red cedar (trace), and western hemlock when present. The reduction in grand fir would increase the proportion of other species in the overstory resulting in a change in cover type. Those units cut with the clearcut or seedtree method would be regenerated with white pine and western larch to assure the presence of these species in the newly establishing stands. Overstory retention in these cuts is minimal due to a lack of seral species presence in the current overstory. The shelterwood cuts would have a mosaic of patches with heavier overstory retention and openings for new establishment. Larger openings may be planted with white pine or western larch as needed. It is predicted that MC cover types would decrease by 1248 acres, the WL/DF cover type would increase by 363 acres, and the WWP cover type would increase by 885 acres. Refer to Table 4-2 for age class changes.

Alternative B – Indirect Effects to Age Class and Cover Type Distribution

Alternative B would treat 30% of the Foothills project area. The MC cover type would decrease from occupying 73% of the Foothills project area to 43% of the area. WL/DF and WWP cover types would increase from 4 to 12 % and 6 to 24%, respectively. The biggest change in age class is the 27% decrease in the 150+ years age class and the 15% increase in the 40-99 years age class.

Alternative B – Cumulative Effects to Age Class and Cover Type Distribution

Alternative B would result in decreasing acreage in the MC cover type and increasing acreage of the WL/DF and WWP cover types. The WWP cover type is appropriate on approximately 6% of the Kalispell landscape. It currently covers less than 1%, but WWP cover type representation would increase to 2% of the Kalispell landscape under Alternative B. The Wildhorse Mountain Timber Sale project will have no change in cover type

distribution, therefore only the Foothills project would contribute to the cumulative effects of cover type distribution. Alternative B would increase the proportion of the Kalispell Landscape in the youngest age classes by less than 1%. Cumulative effects would be in addition to the 500 acre age class change under the Wildhorse Mountain Project resulting in the youngest age classes increasing to 1.44% across the unit. The 150+ years age class would decrease from 39% to 35.9%, without affecting current old growth stands. Across the landscape, fire suppression, insect and disease occurrence, and increasing human use may influence cover type and age class distribution to an unknown degree.

Alternative C – Direct Effects to Age Class and Cover Type Distribution
Alternative C treats 1156 acres (24%) in the Foothills project area. Regeneration harvests would occur on 531 acres and intermediate harvests on 625 acres. Representation of MC cover types would decrease by 956 acres. WL/DF cover type representation would increase 273 acres, and WWP would increase by 684 acres. Refer to Table 4-2 for age class changes.

Table 4-2: Direct or Indirect Effects on Age Class Distribution by Action Alternative

Predicted Acres of Age Class Change by Action Alternative				
	Age Class Group (years)			
Alternative	00 - 39	40- 99	100 - 149	150+
Alt B units	+324 acres	+720 acres	+212 acres	-1256 acres
Alt C units	+278 acres	+454 acres	+212 acres	-944 acres

Alternative C – Indirect Effects to Age Class and Cover Type Distribution
Alternative C would treat 24% of the Foothills project area. Representation of MC cover types in the Foothills project area would decrease from 73% to 53%. WL/DF cover type representation would increase from 4% to 10%, and WWP would increase from 6% to 20%. Under this alternative the 150+ years age class is decreased by 20% and the 40-99 years age class increases by 9%.

Alternative C – Cumulative Effects to Age Class and Cover Type Distribution
Alternative C would result in decreasing acreage in the MC cover type and increasing acreage of the WL/DF and WWP cover types. The WWP cover type is appropriate on approximately 6% of the Kalispell landscape. It currently covers less than 1%, but WWP cover type representation would increase to 1.6% of the Kalispell Landscape under Alternative C. The Wildhorse Mountain Timber Sale project will have no change in cover type distribution, therefore only the Foothills project would contribute to the cumulative effects of cover type distribution. Alternative C would increase the proportion of the Kalispell Landscape in the youngest age classes by less than 1%. Cumulative effects would be in addition to the 500 acre age class change under the Wildhorse Mountain Project resulting in the youngest age classes increasing to 1.36 % across the unit. The 150+ years age class would decrease from 39% to 36.5%, without affecting current old growth stands. Across the landscape, fire suppression, insect and disease occurrence, and increasing human use may influence cover type and age class distribution to an unknown degree.

4.1.2 Distribution of Old Growth Stands

No Action Alternative A – Direct, Indirect and Cumulative Effects to Distribution of Old Growth Stands
Under the no action alternative A, the 22 acre old growth stand in Section 36 would continue to develop under the influence of suppressed wildfire activity and other natural disturbances such as insect and disease activity. Maintenance of old growth characteristics and defining criteria will be dependent on the persistence and the rate of mortality and from the grand fir engraver and white pine blister rust that is currently killing live trees in this stand. If droughty conditions continue in this area, it is expected that the live trees will continue to die resulting in a younger stand, or an old stand of smaller trees in the near future. The natural demise of this stand would result in a negligible decrease in old growth distribution on the Kalispell Unit.

Alternatives B and C – Common Direct, Indirect and Cumulative Effects to Distribution of Old Growth Stands
The 22 acre old growth stand in Section 36 stand is not included in harvest unit acreage under either action alternative B or C. Effects would be the same as described above for Alternative A.

4.1.3 Distribution of Western Hemlock Stands

No Action Alternative A – Direct, Indirect and Cumulative Effects to Distribution of Western Hemlock Stands
Without disturbance those stands containing western hemlock would continue to age and develop closed canopy overstories that shade the forest floor. The diversity of understory flora (tree and plant species) would decline. Large diameter seral species may persist in the overstory and provide a sufficient seed source for restocking at the time of some future disturbance. Disturbances emulating a single, infrequent stand replacement fire would convert these stands initially to shrub/herb fields followed by restocking of both seral and shade tolerant tree species. As the presence of western hemlock is more dependent upon climatic factors rather than types or frequency of disturbances, natural succession as allowed with fire suppression is expected to have negligible effects on the distribution of hemlock in the project area or across the Kalispell Landscape.

Alternatives B and C – Common Direct, Indirect and Cumulative Effects to Distribution of Western Hemlock Stands
The harvest units proposed for both action alternatives B and C include approximately 150 acres in stands with species mixtures that include western hemlock. The hemlock usually occurs in pockets of older, even –aged, closed canopied, hemlock dominated groups between 1- 10 acres in size. These groups are part of the mosaic pattern of the multi-storied, and multi-aged stands proposed for harvesting. Tree removal within the hemlock, dominated pockets would resemble commercial thinning focusing on providing growing space for western larch, Douglas-fir, or western white pine. This would be similar to the occasional ground fires that historically may have occurred in hemlock stands, killing some of the less fire resistant hemlock. Alternative B is expected to modify stand characteristics - decreasing tree stocking and canopy closure, creating various sized openings within or adjacent to hemlock pockets – but is not expected to affect the distribution of hemlock within the project area or cumulatively in the Kalispell Landscape. Alternative C is expected to modify stand characteristics within or adjacent to hemlock pockets, but to a lesser degree than Alternative B, as a result of not treating acres in Alternative B harvest unit K4, and not constructing the .6 miles of Road 21-A2. A 16 acre stand with hemlock would not be modified under Alternative C. The distribution of hemlock within the project area or cumulatively in the Kalispell Landscape would not change, under Alternative C, either.

4.1.4 Stand Structure and Development

No Action Alternative A – Direct and Indirect Effects to Stand Structure and Development
Stand structure and development would continue to change as a result of damaging agents. Older stands comprising 74% of the project area are experiencing noticeable reductions in live tree canopy closure due to fir engraver caused mortality. The mosaic pattern of multi – aged and multi-storied or small even-aged patches are likely to persist with this type of disturbance, resembling the unstable conditions and stand development often associated with late successional forest in the high severity fire regimes. More shade tolerant species would increase in all canopy levels continuing to replace or inhibit growth of seral species, as dense small diameter trees develop in the understory. Area coverage of forest in early successional stages, especially in larger patch sizes would continue to decrease. Forest fuels, both ground and vertical would continue to build up in stand areas where mortality is occurring, increasing the potential for severe, less controllable fires that may result in large scale stand replacement fires.

No Action Alternative A – Cumulative Effects to Stand Structure and Development
Forest succession and fire suppression would continue. Conditions favoring the establishment of shade tolerant species in canopy gaps, the slow growth of seedlings and saplings under closed canopies or the hindrance of tree establishment under closed canopies, and increasing fuel loadings would continue.

Alternative B – Direct and Indirect Effects to Stand Structure and Development
Under Alternative B, 280 acres are proposed for seedtree or clearcut harvest. Logging in these units resembles the role of stand replacement fires, as the majority of the overstory trees are removed. Over portions of the units duff layers are reduced or removed exposing mineral soil that is more favorable to seral tree species seed germination. Succession would be reinitiated in these logging-created openings that would be between 1 acre and 63 acres in size. Stand structure would be even aged and single storied. Most of these units are adjacent to forest stands currently in the early successional stages. Patch size of young, single storied forests as well as area coverage by this type of forest would increase resembling more historic patterns associated with high severity fire regimes. Shelterwood cutting is proposed on 563 acres, and even though it is a regeneration harvest like the cuts above, more overstory trees are retained. These may be retained in groups or individually distributed across the unit depending on current stocking of healthy desirable leave trees. Less homogenous stand conditions would occur, reflecting attributes of forests initiated under the high severity fire regime in the mid successional stages of development, rather than the current late successional stages. These regeneration harvests would generally reduce the mid- and lower-canopy components within harvested stands. Commercial thinning and improvement cutting proposed for 625 acres would maintain current stand ages and structures, although canopy closure and forest fuels would be reduced. Commercial thinning would maintain some of the mid- and lower-canopy, favoring seral species and vigorous trees. These treatments would resemble low severity fires that sometimes occur in the high severity fire group and act as a thinning agent, killing the less fire resistant species such as grand fir and releasing the more fire resistant trees, such as western larch or Douglas-fir. After slash disposal treatments are completed more fire resistant stand conditions and structures would be maintained for several decades.

The percentage of multi-storied stand structures in the Foothills area would be reduced from 84% to 67% and increase the percentage of simpler stand structures from 16% to 34%. Overstory tree canopy closure would be reduced on all harvested acres, reducing the percentage of closed canopy stands in the Foothills area from 92% to approximately 66%. Forest stands with more fire resistant stand conditions and structures would abut approximately 6 miles of private, residential property.

Alternative B – Cumulative Effects to Stand Structure and Development
The area covered by single or two-storied stand structures across the Kalispell Landscape would increase from 18% to 19%. This increase in patch sizes resembling moderate severity fire regimes includes implementation of Alternative B in addition to the Wildhorse Mountain Timber Sale.

Alternative C – Direct and Indirect Effects to Stand Structure and Development
Effects of Alternative C are similar to Alternative B, except for the difference in acreage proposed for the various harvest treatments. Clearcut or seedtree treatments are proposed for 234 acres, with unit size ranging between 8 and 63 acres. Shelterwood cutting would occur on 297 acres, and commercial thinning and improvement cutting would occur on 581 acres.

The percentage of multi-storied stand structures in the Foothills area would be reduced from 84% to 72% and increase the percentage of simpler stand structures from 16% to 27%. Overstory tree canopy closure would be reduced on all harvested acres, reducing the percentage of closed canopy stands in the Foothills area from 92% to approximately 66%. Forest stands with more fire resistant stand conditions and structures would abut approximately 5 miles of private, residential property.

Alternative C – Cumulative Effects to Stand Structure and Development
The area covered by single or two-storied stand structures across the Kalispell Landscape would increase from 18% to slightly less than 19%. This increase in patch sizes resembling moderate severity fire regimes includes implementation of Alternative B in addition to the Wildhorse Mountain Timber Sale.

4.1.5 Timber Productivity and Value

No Action Alternative A – Direct and Indirect Effects to Timber Productivity and Value
Due to the effects of insects and disease the commercial value of sawlogs would continue to decline. Non-sawlog or pulp values are generally less than that received for sawlogs, and the value of this timber trust asset would continue to decline. High incidence of mortality and/or defect is expected to continue in older, grand fir dominated

stands. Growth rates of individual trees in denser, older stands would remain static or continue to decline and opportunities for establishment of replacement trees would be limited to small openings favoring shade tolerant trees that are more susceptible to stem decays. These species often have lower commercial sawlog values than white pine, western larch, or Douglas-fir. Development of larger diameter commercially valuable western larch as a persistent component in the overstory of older stands would be hindered. Loss of dead and dying trees along both open and closed roads would continue to occur from activities associated with firewood gathering and maintenance of powerline corridors and public right-of-way easements. The request for small - scale salvage permits would likely increase.

No Action Alternative A – Cumulative Effects to Timber Productivity and Value
Without silvicultural treatments or wildfires to control tree densities, reduce losses to insects or disease, recover mortality or initiate new stands, the trend towards increasing acreage on the Kalispell Unit, covered by older, slower growing stands that are more susceptible to beetle infestations, stem decays, or wildfires would continue.

Alternatives B and C – Common Direct and Indirect Effects to Timber Productivity and Value
Silvicultural treatments to be applied under the action alternatives would remove both live and dead trees, many of which are affected by insects or diseases. Healthy and vigorous trees of species other than grand fir would be favored for retention where they occur. Snags and snag recruits in quantities meeting DNRC requirements would be left. Larger diameter snags and cull trees, especially shade intolerant species, if not infected with dwarf mistletoe would be favored for potential snag recruits and snag retention. Some groups of healthy, sapling to pole sized trees would be retained or thinned, especially along open roads, streams, springs, and wetlands. Due to the removal of low vigor or diseased trees stand health would improve. Between-tree competition would be reduced allowing residual trees to maintain or increase current growth rates. The number of leave trees/acre would be dependent on availability and is reflected in the types of cuts. In Table 4-3 an estimate of canopy coverage is used to display the density or stocking levels of residual trees to depict the level of tree removal or retention under the various cuts.

Table 4-3: Residual Tree Stocking Levels by Alternative

Before Harvest	**After Harvest**			
% Canopy Closure	Type of Harvest Cut	Alternative B	% Canopy Closure	Alternative C
60-80%	Clearcut	32 acres	< 5%	20 acres
50 – 80%	Seedtree	248 acres	5 - 10%	214 acres
70 + %	Shelterwood	563 acres	20 – 30%	297 acres
80%	Commercial thin	19 acres	40%	19 acres
70 + %	Improvement	562 acres	40 –60%	562 acres
70%	Overstory Removal	44 acres	> 60%	44 acres

Where seedtree, clearcut, or shelterwood cuts (regeneration harvests) are applied logging slash would be trampled, machine piled and burned or burned in place. These activities would reduce the immediate increase in fire hazard from the increased loading of flashy fuels and would prepare the site for new tree establishment. Mineral soil would be exposed on approximately 30 –40% of the area to promote germination of western larch, Douglas-fir, western white pine, or lodgepole pine seed. These areas would also be planted with a mixture of western larch and blister resistant white pine to assure appropriate representation of these species.

Commercial thinning, overstory removal, and improvement cutting (intermediate harvests) would remove fewer trees, producing less flashy fuel loadings. Fire hazard reduction in these units would consist of a combination of methods that would include trampling, machine piling and burning spots of heavier concentrations, cutting limbs and tops to lay low to the ground, and gathering tops at the landing for burning. Residual trees would adequately stock these units with healthy and vigorous trees.

Alternative B – Direct and Indirect Effects to Timber Productivity and Value
Silvicultural treatments would be applied to 1468 acres, or 30% of the Foothills project area under Alternative B. The effects for the various types of cuts as described above would occur on the treated acres. Regeneration harvests would be used to treat 843 acres, and intermediate harvests to treat 625 acres. Timber productivity on the treated acres would increase or be maintained at a level closer to the site potential, improving the future opportunities for generating revenue for the trust with the use of the timber resource.

Alternative B – Cumulative Effects to Timber Productivity and Value
The percentage of forested land that is producing timber closer to the site potential would increase by approximately 3 % on the Kalispell Unit. The acres of forest stands that are less susceptible to beetle infestations, stem decays, or wildfires would increase. Higher potential for greater long - term revenue from the timber resource is expected.

Alternative C – Direct and Indirect Effects to Timber Productivity and Value
Silvicultural treatments would be applied to 1156 acres, or 24% of the Foothills project area under Alternative C. The effects for the various types of cuts as described above would occur on the treated acres. Regeneration harvests would be used to treat 531 acres, and intermediate harvests to treat 625 acres. Timber productivity on the treated acres would increase or be maintained at a level closer to the site potential, improving the future opportunities for generating revenue for the trust with the use of the timber resource.

Alternative C – Cumulative Effects to Timber Productivity and Value
The percentage of forested land that is producing timber closer to the site potential would increase by approximately 2 % on the Kalispell Unit. The acres of forest stands that are less susceptible to beetle infestations, stem decays, or wildfires would increase. Higher potential for greater long - term revenue from the timber resource is expected.

4.1.6 Sensitive Plants

No Action Alternative A – Direct and Indirect Effects to Sensitive Plants
Recreational motorized use of open road BL2 is would continue year round. This activity could result in further disturbance of the compromised mountain moonwort population at the end of this road, if spring motorized use occurred. If annual weed control measures included this road, herbicide treatments would be curtailed 100 feet prior to the end of the road. Unauthorized grazing in Section 36 has been ceased to avoid further impacts to this area. Threats to other localized sensitive plant populations identified in section 3.1.6 of the analysis, under current conditions were not identified, and effects other than those associated with natural events such as blow down or annual variations of water levels within wetland complexes would not be expected. Other road closures or stream crossing improvements on existing roads may occur over the next decade as funding and unit priorities allow, decreasing existing sources of sediment delivery that may affect water nutrient levels and mountain moonwart.

No Action Alternative A – Cumulative Effects to Sensitive Plants
Cumulative effects to the distribution or viability of sensitive plants populations are not expected under the no action alternative. Minor salvage permits, forest improvement activities, firewood cutting, or right-of-way and powerline easement maintenance that may occur within the project area are not expected to result in a measurable change to water levels or nutrient levels which might affect mountain moonwart. Given the widely scattered nature of the Kalispell Unit lands, other projects are outside this basin and would have no effect on sensitive plant habitat or populations, within the Foothills project area or outside.

Alternatives B and C – Common Direct and Indirect Effects to Sensitive Plants
Neither action alternative has harvest units located near wetland complexes with identified sensitive species populations, other than Harvest Unit BL-2. Winter logging is proposed in this unit, and road BL2 would be gated to restrict use. Riparian areas near proposed harvesting would be protected from logging impacts by marking Streamside Management Zones (SMZs), Wetland Management Zones (WMZs) or equipment restriction areas. Logging operations involving heavy equipment use off road would be restricted to dry, frozen or snow covered soil conditions.

Water-yield increases or a change in nutrient levels caused by timber harvesting could result in changes to water and nutrient levels in fens, streams, and wet meadows. Increased or decreased water or nutrient levels could result in changes to local populations of sensitive plants. Given that the Foothills area is a large hydrologic basin fed by a huge system with a sizeable amount of water available, the level of harvesting under either alternative is not expected to affect a change in nutrient levels or measurable changes in water yields. Application of mitigation measures to prevent erosion and sediment delivery would further limit the potential for changes in nutrient levels within wetland complexes.

Alternatives B and C – Common Cumulative Effects to Sensitive Plants
Minor salvage permits, forest improvement activities, firewood cutting, or right-of-way and powerline easement maintenance may occur within the project area in addition to the proposed timber harvesting. These activities in addition to the proposed harvest, under either alternative, are not expected to result in a measurable change to water levels or nutrient levels. Given the widely scattered nature of the Kalispell Unit lands, other projects are outside this basin and would have no effect on sensitive plant habitat or populations, within the Foothills project area or outside.

4.1.7 Noxious Weeds

No Action Alternative A – Direct and Indirect Effects to Noxious Weeds
Weed seed would continue to be spread or be introduced throughout the project area from recreational use, residential development and use adjacent to state land or within, and commercial and non-commercial use of open roads. Herbicide treatment along open, public roads and enhancement of road closures would continue as funding and unit priorities allow. Containment of weed infestation areas or a reduction of weed infested acres may be realized.

No Action Alternative A – Cumulative Effects to Noxious Weeds
Cumulatively the potential spread of weed seeds and increases in areas where weed populations could start is possible under the no action alternative, across the Kalispell Landscape, as well. With adoption of ARM 36.11.445 and implementation of Cooperative Noxious Weed Agreements with Flathead, Lake, and Lincoln counties, a more aggressive approach to identification and treatment of noxious weeds has occurred than in the past. This ongoing treatment of noxious weeds should limit large increases in noxious weed spread and may reduce the number of acres infested in the future.

Alternatives B and C – Common Direct and Indirect Effects to Noxious Weeds
Logging disturbance would increase the potential for further establishment of noxious weeds with the exposure of mineral soil in skid trails, landings, existing roads, new road construction, abandoned temporary roads and road improvement sites. Applying integrated weed management techniques within the sale design would reduce the occurrences and spread of weeds. Grass seeding new and disturbed roads and landings and spot spraying new weed infestations would reduce or prevent establishment of additional populations. Washing logging equipment prior to use would limit the introduction of weed seeds into the forest. Trampling slash in skid trails and closing additional roads would limit the potential for soil disturbance within these routes during or after logging, reducing the potential for weed establishment. Treating existing weed populations along or within roads with herbicide spray would reduce current weed populations, or contain the area of infestation.

Alternative B –Direct and Indirect Effects to Noxious Weeds
Under Alternative B, harvesting would occur on 1468 acres, and involve road work on approximately 35 miles of state roads. Acreage within harvest units are at higher risk of incurring weed establishment within the units due to soil disturbances that may occur from skidding, landing, and heavy equipment use for scarifying or fuels reduction treatments. This risk would be limited by mitigation measures described above. Enhancement of existing road closures, trampling slash in road prisms, grass seeding sites disturbed during road construction or work, and additional road closures in combination with spot herbicide treatments would reduce current coverage of weed populations and limit the potential risk of further establishment.

Alternative C –Direct and Indirect Effects to Noxious Weeds
Under Alternative C, harvesting would occur on 1156 acres, and involve road work on approximately 29 miles of state roads. Acreage within harvest units are at higher risk of incurring weed establishment due to soil

disturbances that may occur from skidding, landing, and heavy equipment use for scarifying or fuels reduction treatments. This risk would be limited by mitigation measures described above. Enhancement of existing road closures, trampling slash in road prisms, grass seeding sites disturbed during road construction or work, and additional road closures in combination with spot herbicide treatments would reduce current coverage of weed populations and limit the potential risk of further establishment.

Alternatives B and C – Common Cumulative Effects to Noxious Weeds
Both alternatives, in combination with other management activities and recreational use of the Kalispell Landscape, would increase the risk of further encroachment of forested sites by noxious weeds. The potential risk would be limited with the use of prevention measures implemented under County Weed plans in addition to the site-specific mitigation measures for the Foothills project. Actual treatments are likely to be applied to a more extensive area under the action alternatives, and have a greater potential for reducing current weed populations within the project area, thereby reducing the noxious weed affected area within the Kalispell Landscape.

Predicted Effects of Potential Timber Conservation License on Vegetation
An application has been submitted for a 'timber conservation license in lieu of sale' that may be issued in conjunction with either action alternative. The potential timber conservation area is approximately one acre in size within proposed harvest unit B1. Due to the location and minor extent of the timber conservation area, neither positive nor negative foreseeable impacts to vegetation resources in the Foothills Project Area would be expected to occur if the 'timber conservation license in lieu of sale' is accepted. Therefore, as a result of the acceptance of the 'timber conservation license in lieu of sale' there would be no additional direct, indirect, or cumulative impacts to old growth, vegetation attributes, sensitive plant, or noxious weeds.

4.2 PREDICTED EFFECTS ON WATERSHED AND HYDROLOGY

4.2.1 Water Quality

No Action Alternative A – Direct and Indirect Effects to Water Quality
Direct and indirect effects of the No Action alternative would be similar to the conditions described under the existing conditions for water quality. Water quality would be unaffected by the no action alternative, and streams in the proposed project area would continue to be affected by natural and pre-existing conditions.

No Action Alternative A – Cumulative Effects to Water Quality
Cumulative effects of the No Action alternative on water quality would be similar to the situations described in the existing conditions. Water quality would be unaffected by the No Action alternative, and the streams and other drainage features in the proposed project area would continue to be affected by natural and pre-existing conditions.

Alternative B – Direct and Indirect Effects to Water Quality
Alternative B would reduce the overall sediment contribution to project area streams. Reductions in sediment delivery would happen due to installation of BMPs on several existing stream crossings, and replacement of stream crossing structures that are not adequately designed. Sediment reductions within individual project area watersheds are displayed in Table 4-4. Alternative B would improve the erosion control and surface drainage on approximately 15.8 miles of existing road, and bring it up to applicable BMP standards. In addition, 1.1 miles of new permanent road, and 1.8 miles of temporary road would be constructed to access the proposed harvest units. All new road construction would comply with all applicable BMP standards. The proposed road work would create an increase in erosion risk for a period of one to three years due to bare soil exposure, but would lower the long term erosion levels from current levels by installing properly sized structures, and providing adequate surface drainage relief. All appropriate permits from the Montana Department of Fish, Wildlife and Parks, and from the Montana Department of Environmental Quality would be acquired prior to any road construction activities on stream crossings, and all water quality standards would be met during the course of construction activities per the stipulations of applicable permits. All beneficial uses are expected to be met with the proposed activities in Alternative B.

Alternative B –Cumulative Effects to Water Quality
Risk of sediment delivery in the proposed project area would be reduced from current levels by an estimated 12.5 tons per year with Alternative B. Cumulative sediment loading to downstream waters would be reduced through implementation of Alternative B. Expected sediment loading estimates for each project area watershed are found in Table 4-4. Sediment yield values reported in Table 4-4 include increases in sediment due to road reconstruction and new road construction. Improvement and installation of erosion control and surface drainage on the existing road system would reduce erosion rates from current levels and reduce the risk of sediment delivery to downstream waters.

Table 4-4. Current Road Sediment Delivery Estimates in Foothills Project Area

Watershed	Sediment Yield (tons/yr)	
	Existing	Proposed[1]
Birch	0.02	0.02
Deer	0.02	0.02
Echo	3.7	0.84
Krause	0.03	0.03
Noisy	1.2	0.08
Patterson	0.12	0.08
Rocky	8.8	0.23
Total for Project Area	**13.8**	**1.3**

[1] Improvements to existing roads are the same for Alternatives B and C for sediment yield purposes. This is due primarily to the fact that neither alternative proposes to construct a new stream crossing, and all proposed reconstruction on and near stream crossings in Alternative B is also proposed in Alternative C. Additional road reconstruction proposed in Alternative B is located away from stream crossings, and not currently delivering sediment to a stream.

Alternative C – Direct and Indirect Effects to Water Quality
Alternative C would reduce the overall sediment contribution to project area streams. Reductions in sediment delivery would happen due to installation of BMPs on several existing stream crossings, and replacement of stream crossing structures that are not adequately designed. Sediment reductions within individual project area watersheds are displayed in Table 4-4. Alternative C would improve the erosion control and surface drainage on approximately 13.7 miles of existing road, and bring it up to applicable BMP standards. In addition, 1 mile of temporary road would be constructed to access the proposed harvest units. All new road construction would comply with all applicable BMP standards. The proposed road work would create an increase in erosion risk for the first year due to bare soil exposure, but would lower the long term erosion levels from current levels by installing properly sized structures, and providing adequate surface drainage relief. All appropriate permits from the Montana Department of Fish, Wildlife and Parks, and from the Montana Department of Environmental Quality would be acquired prior to any road construction activities on stream crossings, and all water quality standards would be met during the course of construction activities per the stipulations of applicable permits. All beneficial uses are expected to be met with the proposed activities in Alternative C.

Alternative C – Cumulative Effects to Water Quality
Risk of sediment delivery in the proposed project area would be reduced from current levels by an estimated 12.5 tons per year with Alternative C. Cumulative sediment loading to downstream waters would be reduced through implementation of Alternative C. Expected sediment loading estimates for each project area watershed are found in Table 4-4. Improvement and installation of erosion control and surface drainage on the existing road system would reduce erosion rates from current levels and reduce the risk of sediment delivery to downstream waters.

4.2.2 Water Yield

No Action Alternative A – Direct and Indirect Effects to Water Yield
Direct and indirect effects of the No Action alternative would be similar to the conditions described under the existing conditions for water yield. Water yield would be unaffected by the no action alternative, and the streams within the proposed project area would continue to be affected by natural and pre-existing conditions.

No Action Alternative A – Cumulative Effects to Water Yield

Cumulative effects of the No Action alternative on water yield would be similar to the situations described in the existing conditions. Water yield would be unaffected by the No Action alternative, and streams within the proposed project area would continue to be affected by natural and pre-existing conditions.

Alternative B – Direct and Indirect Effects to Water Yield

Alternative B would harvest timber from approximately 1,468 acres. Of these acres, 258 are located in areas with no defined streams or other drainage features. The remaining 1,210 acres are located within the watersheds listed in Table 4-5. Harvest activities proposed within these watersheds are estimated to generate annual water yield increases ranging from as little as 0.1% in Wolf Creek, to as much as 3.8% in Rocky Creek. Projected increases in water yield for each watershed in the proposed project area are listed in Table 4-5 under the "% WYI" rows. The row titled "Generated by Alt B" represents the expected water yield increases as a result of Alternative B. These levels of increase are not expected to be large enough to cause channel instability, and leave each watershed well within its allowable water yield increase. The stability of channels, where channels exist, would be sufficient to handle these increases. It is not expected that these increases in water yield would create surface flow to any other body of water beyond that occurring under the existing conditions.

Alternative B – Cumulative Effects to Water Yield

Past activity in and around the proposed project area has mainly consisted of timber management. On sites where timber was harvested, there has been substantial vegetative and hydrologic recovery with no apparent impact to stream channels from water yield increases.

Table 4-5 shows the cumulative impacts, by watershed, of Alternative B to water yield in the "% WYI" rows. The change from "Existing" to "Proposed Cumulative" represents the cumulative effects to water yield from all past management activities combined with the proposed activities with the Foothills Timber Sale proposal. These levels remain well below the allowable water yield increase, and would not be sufficient to cause in-channel adjustments to flows. The stability of the channels, where they exist, would not be changed by the proposal, and the projected increases in watersheds without defined channels would likely not lead to scouring of a new channel as a result of the proposed project. Display of ECA values shows the level of harvesting that could take place before a watershed would approach its water yield increase threshold. Levels of ECA are directly tied to water yield increase values, and are an additional way to reference levels of past activity and allowable activity in a watershed.

Table 4-5. Alternative B - Estimated Water Yield and ECA Increases in Foothills Project Area

		Watershed									
		Bear	Birch	Deer	Echo	Krause	Noisy	Patterson	Peterson	Rocky	Wolf
%WYI	Allowable	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	Existing	0.3	1.4	2.4	5.2	1.0	1.4	0.8	1.3	3.5	0.6
	Generated by Alt. B	0.5	0.4	0.5	2.7	0.2	0.4	0.2	0.2	3.8	0.1
	Proposed Cumulative[1]	0.8	1.8	2.9	7.9	1.2	1.8	1.0	1.5	7.3	0.7
ECA	Allowable	495	931	787	861	1,169	1,145	837	712	679	1,464
	Existing	18	198	253	286	140	187	133	155	252	215
	Generated by Alt. B[2]	52	88	93	272	53	122	42	34	336	38
	Proposed Cumulative[1]	70	286	346	558	193	309	175	189	588	253

1 – Includes existing levels and the estimated increase from the proposed alternative
2 – Refers only to the ECA generated by the proposed alternative B, including roads and harvest

Alternative C – Direct and Indirect Effects to Water Yield

Alternative C would harvest timber from approximately 1,156 acres. Of these acres, 256 are located in areas with no defined streams or other drainage features. The remaining 900 acres are located within the watersheds listed in Table 4-6. Harvest activities proposed within these watersheds are estimated to generate annual water yield increases ranging from as little as no increase in Deer Creek, to as much as 3.8% in Rocky Creek. Projected increases in water yield for each watershed in the proposed project area are listed in Table 4-6 under the "% WYI" rows. The row titled "Generated by Alt. C" represents the expected water yield increases as a result of Alternative C. These levels of increase would not be large enough to cause channel instability, and leave each watershed well within its allowable water yield increase. The stability of channels, where channels exist, would be sufficient to handle these increases. It is not expected that these increases in water yield would create surface flow to any other body of water beyond that occurring under the existing conditions.

Alternative C – Cumulative Effects to Water Yield

Past activity in and around the proposed project area has mainly consisted of timber management. On sites where timber was harvested, there has been substantial vegetative and hydrologic recovery with no apparent impact to stream channels from water yield increases.

Table 4-6 shows the cumulative impacts, by watershed, of Alternative C to water yield in the "% WYI" rows. The change from "Existing" to "Proposed Cumulative" represents the cumulative effects to water yield from all past management activities combined with the proposed activities with the Foothills Timber Sale proposal. These levels remain well below the allowable water yield increase, and would not be sufficient to cause in-channel adjustments to flows. The stability of the channels, where they exist, would not be changed by the proposal, and the projected increases in watersheds without defined channels would likely not lead to scouring of a new channel as a result of the proposed project. Display of ECA values shows the level of harvesting that could take place before a watershed would approach its water yield increase threshold. Levels of ECA are directly tied to water yield increase values, and are an additional way to reference levels of past activity and allowable activity in a watershed.

Table 4-6. Alternative C - Estimated Water Yield and ECA Increases in Foothills Project Area

		Watershed									
		Bear	Birch	Deer	Echo	Krause	Noisy	Patterson	Peterson	Rocky	Wolf
%WYI	Allowable	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	Existing	0.3	1.4	2.4	5.2	1.0	1.4	0.8	1.3	3.5	0.6
	Generated by Alt. C	0.5	0.1	0	1.9	0.2	0.2	0.2	0.2	3.8	0.1
	Proposed Cumulative[1]	0.8	1.5	2.4	7.1	1.2	1.6	1.0	1.5	7.3	0.7
ECA	Allowable	495	931	787	861	1,169	1,145	837	712	679	1,464
	Existing	18	198	253	286	140	187	133	155	252	215
	Generated by Alt. C[2]	52	5	2	198	53	65	42	34	336	38
	Proposed Cumulative[1]	70	203	255	484	193	252	175	189	588	253

1 – Includes existing levels and the estimated increase from the proposed alternative
2 – Refers only to the ECA generated by the proposed alternative C, including roads and harvest

Predicted Effects of Potential Timber Conservation License on Watershed and Hydrology
An application has been submitted for a 'timber conservation license in lieu of sale' within the Bear Creek drainage (M. Friedland, 06/07/05). The potential timber conservation area is approximately one acre in size within proposed harvest unit B1 and approximately 1,400 feet from Bear Creek. The proposed timber conservation license would remove one acre of proposed harvest from each of Alternatives B and C. This would produce direct, indirect and cumulative effects similar to those described in the No Action alternative on the water quality and water yield within the proposed timber conservation license. Due to the limited acreage of the proposed timber conservation license and its distance from Bear Creek and other bodies of water, the direct, indirect and cumulative impacts of Alternatives B and C would be the same with or without execution of the proposed timber conservation license in lieu of sale.

4.3 PREDICTED EFFECTS ON SOILS

Analysis Methods
Soil effects and conditions will be analyzed by evaluating the current levels of soil disturbance in the proposed project area. Analysis will also include assessing slope stability.

Analysis Area
The analysis area for evaluating soil productivity will include DNRC owned land within the Foothills project area. The proposed project area is found within the Krause Creek, Echo Creek, Noisy Creek, Rocky Creek, Birch Creek, Deer Creek, Wolf Creek, Bear Creek, Peterson Creek and Patterson Creek watersheds.

No Action Alternative A – Direct and Indirect Effects to Soil Productivity
Alternative A would have no direct or indirect effects on soil productivity. No ground-based activity would take place under this alternative, which would leave the soil in the project area unchanged from the description in the Existing Conditions portion of this analysis.

No Action Alternative A – Cumulative Effects to Soil Productivity
This alternative would have no additional cumulative impacts on soil productivity. No soil would be disturbed under this alternative, and no re-entry of past harvest units would occur with Alternative A. Cumulative effects of this alternative would be similar to those described under the existing conditions portion of this analysis.

Alternative B – Direct and Indirect Effects to Soil Productivity
Alternative B would have direct impacts on up to 220 acres of combined skid trails, landings and impacted spots. Direct impacts to soils would include compaction and displacement resulting from use of ground-based equipment to skid logs on approximately 1,466 acres. Ground based site preparation and road construction would also generate direct impacts to the soil resource. Table 4-7 summarizes the expected impacts to the soil resource as a result of Alternative B with summer harvest operations on relatively dry soils. These activities would leave up to 15% of the proposed harvest units with impacted soil conditions. Table 4-8 summarizes the expected impacts to the soil resource as a result of Alternative B if the project were harvested under frozen or snow-covered conditions. These activities would leave up to 4% of the proposed harvest units with impacted soil conditions. The DNRC expects to maintain long-term soil productivity based upon the implementation of mitigation measures to control the area and degree of detrimental soil impacts to 15% or less of the proposed harvest area. A combination of skidding and slash treatment mitigation measures would include: restricting the season-of-use, utilizing a minimum skid trail spacing, installing erosion control where needed, retaining 10-15 tons per acre of woody debris and following all applicable BMPs. Alternative B is not expected to have any impact on slope stability in the proposed project area.

Table 4-7: Summary of Direct Effects of Alternatives on Soils with Summer Harvest

Description of Parameter	Alternative A	Alternative B	Alternative C
Acres of Harvest	0	1,466	1,155
Acres of tractor yarding	0	1,466	1,155
Acres of skid trails and landings[1]	0	293	231
Acres of moderate impacts[2]	0	220	173
Percent of harvest area with impacts	<10%	15.0%	15.0%

[1] 20 percent of ground based area
[2] 75 percent of ground-based skid trails and 50% of cable corridors

Table 4-8: Summary of Direct Effects of Alternatives on Soils with Harvest on Snow-Covered or Frozen Conditions

Description of Parameter	Alternative A	Alternative B	Alternative C
Acres of Harvest	0	1,466	1,155
Acres of tractor yarding	0	1,466	1,155
Acres of skid trails and landings[1]	0	293	231
Acres of moderate impacts[2]	0	59	46
Percent of harvest area with impacts	<10%	4.0%	4.0%

[1] 20 percent of ground based area
[2] 20 percent of ground-based skid trails and 50% of cable corridors

Alternative C – Direct and Indirect Effects to Soil Productivity

Alternative C would have direct impacts on up to 173 acres of combined skid trails, landings and impacted spots. Direct impacts to soils would include compaction and displacement resulting from use of ground-based equipment to skid logs on approximately 1,155 acres. Ground based site preparation and road construction would also generate direct impacts to the soil resource. Table 4-7 summarizes the expected impacts to the soil resource as a result of Alternative C with summer harvest operations on relatively dry soils. These activities would leave up to 15% of the proposed harvest units with impacted soil conditions. Table 4-8 summarizes the expected impacts to the soil resource as a result of Alternative C if the project were harvested under frozen or snow-covered conditions. These activities would leave up to 4% of the proposed harvest units with impacted soil conditions. The DNRC expects to maintain long-term soil productivity based upon the implementation of mitigation measures to control the area and degree of detrimental soil impacts to 15% or less of the proposed harvest area. A combination of skidding and slash treatment mitigation measures would include: restricting the season-of-use, utilizing a minimum skid trail spacing, installing erosion control where needed, retaining 10-15 tons per acre of woody debris and following all applicable BMPs. Alternative C is not expected to have any impact on slope stability in the proposed project area.

Alternatives B and C – Common Cumulative Effects to Soil Productivity

Both action alternatives would enter several stands where previous timber management has occurred. Under Alternative B, approximately 1,215 of the 1,466 acres proposed for harvest have been previously entered; and under Alternative C, approximately 942 of the 1,155 acres proposed for harvest have been previously entered. As stated in the Existing Conditions portion of this analysis, most of the skid trails in previously harvested areas have ameliorated through re-vegetation and frost action. Cumulative effects to soils may occur from repeated entries into a forest stand, where additional ground is impacted by equipment operations. DNRC would maintain long-term soil productivity and minimize adverse cumulative effects by implementing any or all of the following: 1) existing skid trails from past harvest activities would be used if they are properly located and spaced 2) additional skid trails would be used only where existing trails are unacceptable 3) mitigating the potential direct and indirect effects with soil moisture restrictions, season of operation, and method of harvest 4) retention of 10-15 tons per acre of coarse woody debris and fine litter for nutrient cycling. The DNRC expects cumulative effects to soil productivity to be 20% or less of harvested areas, including impacts from past harvesting. In most of the proposed project area, cumulative impacts would be less than 15%. In previously unharvested stands, cumulative effects to soil productivity from multiple entries would be the same as those listed in the direct and indirect effects sections. For slash treatment, equipment piling of slash and site preparation would be limited to less than 30% scarified soils within regeneration harvest units Future stand entries would likely use existing trails and landings.

Effects of Potential Timber Conservation License on Soils

An application has been submitted for a 'timber conservation license in lieu of sale' within the Bear Creek drainage (M. Friedland, 06/07/05). The potential timber conservation area is approximately one acre in size within proposed harvest unit B1 and approximately 1,400 feet from Bear Creek. The proposed timber conservation license would remove one acre of proposed harvest from each of Alternatives B and C. This would produce direct, indirect and cumulative effects similar to those described in the No Action alternative on the soil resource within the proposed timber conservation license. Due to the limited acreage of the proposed timber conservation license, the direct, indirect and cumulative impacts of Alternatives B and C would be the same with or without execution of the proposed timber conservation license in lieu of sale.

4.4 PREDICTED EFFECTS ON FISHERIES

The purpose of this fisheries analysis is the assessment of potential impacts to cold-water fisheries within the Foothills Timber Sale project area as a result of any one of the project alternatives. The assessment of environmental effects in this fisheries analysis is based in part on the assumption that the Specialist Recommendations (see Fisheries Analysis Appendix A) will be implemented through timber sale contract specification and monitoring.

'Alternative A' is a no action alternative. Existing Conditions relative to fisheries in the project area would remain unchanged as a result of the selection of this alternative. 'Alternative B' is an action alternative involving 41 proposed timber harvest units. Approximately 1,468 acres would be harvested using various silviculture prescriptions. Actions associated with Alternative B would occur in the all of the watersheds containing fish-bearing streams in the project area. 'Alternative C' is an action alternative involving 31 proposed timber harvest units. Approximately 1,156 acres would be harvested using various silviculture prescriptions. Actions associated with Alternative B would occur in the all of the watersheds containing fish-bearing streams in the project area. See Chapter 2 in the Draft and Final Environmental Impact Statements of Foothills Timber Sale for detailed information, specific mitigations, and road management plans pertaining to Alternatives A, B, and C.

4.4.1 Effects on Populations – Presence and Genetics

No Action Alternative A: Direct and Indirect Effects to Populations - Presence and Genetics
As a result of the selection of Alternative A, there would be no direct or indirect impacts to fisheries presence and genetics in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Direct and Indirect Effects to Populations - Presence and Genetics
The proposed actions of Alternative B do not involve the manipulation of fisheries presence in project area. The proposed actions also do not involve the control or manipulation of fisheries genetics in the project area. The management of fisheries presence and genetics is beyond the control of DNRC land management activities.

As a result of the selection of Alternative B, there is not expected to be any direct or indirect impacts to fisheries presence and genetics in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative C: Direct and Indirect Effects to Populations - Presence and Genetics
As a result of the selection of Alternative C, the direct and indirect impacts to fisheries presence and genetics in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.

4.4.2 Effects on Habitat – Flow Regimes

No Action Alternative A: Direct and Indirect Effects to Habitat – Flow Regimes
As a result of the selection of Alternative A, there will be no direct or indirect impacts to the fisheries habitat variable of flow regime in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Direct and Indirect Effects to Populations – Flow Regimes
Changes in flow regime can affect native and non-native fish spawning migration, spawning behavior, potential spawning habitat, and embryo survival through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. An analysis of the proposed actions related to Alternative B indicates that water yields would increase from 0.1 percent (Wolf Creek) to 3.8 percent (Rocky Creek and Station Creek)(see Hydrology Analysis). Table 4-9 describes the expected increases for each basin in this analysis. The expected changes to flow regimes in Table 4-9 are increases above those values described in the Existing Conditions. The expecting increase in flow regime to the Swan River is likely to be negligible (see Hydrology Analysis).

Table 4-9: Expected increases in flow regime from basins in the Foothills Timber Sale project area as a result of Alternative B.

Stream basin	Expected increase (percent) in flow regimes as a result of implementing Alternative B
Krause Creek	0.2%
Echo Creek	2.7%
Noisy Creek	0.4%
Rocky Creek and Station Creek	3.8%
Birch Creek	0.4%
Wolf Creek	0.1%
Bear Creek	0.5%
Peterson Creek	0.2%
Patterson Creek	0.2%

The expected 0.1 to 3.8 percent increase in flow regime to basins in the project area could affect native and non-native fisheries. However, the expected slight increases and consequent potential adverse effect is not likely to have a detectable or otherwise measurable impact to native and non-native fisheries in the project area. With respect to those existing conditions described at the beginning of this analysis, these potential modifications of flow regimes as a result of the selection of Alternative B are expected to have a low risk of direct and indirect impacts to the fisheries habitat variable of flow regime in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River.

Alternative C: Direct and Indirect Effects to Populations – Flow Regimes

Changes in flow regime can affect native and non-native fish spawning migration, spawning behavior, potential spawning habitat, and embryo survival through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. An analysis of the proposed actions related to Alternative C indicates that water yields would increase from 0.1 percent (Birch Creek and Wolf Creek) to 3.8 percent (Rocky Creek and Station Creek)(see Hydrology Analysis). Table 4-10 describes the expected increases for each basin in this analysis. The expected changes to flow regimes in Table 4-10 are increases above those values described in the Existing Conditions. The expecting increase in flow regime to the Swan River is likely to be negligible (see Hydrology Analysis).

Table 4-10: Expected increases in flow regime from basins in the Foothills Timber Sale project area as a result of Alternative C.

Stream basin	Expected increase (percent) in flow regimes as a result of implementing Alternative C
Krause Creek	0.2%
Echo Creek	1.9%
Noisy Creek	0.2%
Rocky Creek and Station Creek	3.8%
Birch Creek	0.1%
Wolf Creek	0.1%
Bear Creek	0.5%
Peterson Creek	0.2%
Patterson Creek	0.2%

The expected 0.1 to 3.8 percent increase in flow regime to basins in the project area could affect native and non-native fisheries. However, the expected slight increases and consequent potential adverse effect is not likely to have a detectable or otherwise measurable impact to native and non-native fisheries in the project area. With respect to those existing conditions described at the beginning of this analysis, these potential modifications of flow regimes as a result of the selection of Alternative C are expected to have a low risk of direct and indirect impacts to the fisheries habitat variable of flow regime in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River.

4.4.3 Effects on Habitat – Sediment and Channel Forms

No Action Alternative A: Direct and Indirect Effects to Habitat – Sediment and Channel Forms
As a result of the selection of Alternative A, there will be no direct or indirect impacts to the fisheries habitat variables of sediment and channel form in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Direct and Indirect Effects to Populations – Sediment and Channel Forms
Modifications of stream sediment size classes, especially with trends toward fine size classes, could adversely affect fisheries in the project area by reducing the quality of spawning habitat, in-stream cover, rearing habitat, and wintering habitat. Increased levels of fine sediments can be introduced to the stream system from various sources, including bank erosion due to stream channel instability, road features, and adjacent timber harvest operations.

Data from the Hydrology Analysis in this EIS indicates that the range of potential water yield increases as a result of Alternative B is generally insufficient to facilitate the development unstable stream channels.

One new road-stream crossing structure of Birch Creek (SE1/4 NW1/4 T27N R19W Section 2) would be built under Alternative B, and this new structure would be a temporary bridge at an existing, failed culvert road-stream crossing site. Three other existing road-stream crossing sites that would be utilized under Alternative B include one existing culvert crossing of upper Rocky Creek (SE1/4 SE1/4 T28N R19W Section 34), one existing culvert crossing of Station Creek (NW1/4 NW1/4 T27N R19W Section 2), and one existing bridge crossing of Patterson Creek (NW1/4 SE1/4 T27N R19W Section 36). Forestry Best Management Practices will be implemented at all road-stream crossings, which will mitigate potential sedimentation to fish-bearing streams. There is a low risk of sedimentation to lower Rocky Creek, Birch Creek, and Patterson Creek as a result of the road-stream crossing use proposed in Alternative B.

The Hydrology Analysis also indicates that road improvements associated with Alternative B would reduce long-term sedimentation from low to moderate grade roads in the project area. Road improvement activities that remove or mitigate potential sediment sources may have temporary, unavoidable, and short-term impacts to the sediment component of streams (see Hydrology Analysis), which may correspond to a minor, short-term impact to fisheries. However, these road improvements would provide a long-term, net positive impact to fisheries habitat in respect to sediment.

Timber harvest operations adjacent to fish-bearing stream in the project area would comply with Streamside Management Zone (SMZ) laws and Forest Management Administrative Rules. The SMZ laws and Forest Management Administrative Rules are designed to provide adequate mitigations for the prevention of sedimentation to streams from adjacent timber harvest related activities.

Potential changes to stream channel forms are primarily a function of modifications to flow regimes and consequent relationships with existing sediment size classes. With respect to those existing conditions described in Section 3, the selection of Alternative B would have a low risk of direct and indirect impacts to the sediment and channel form components of fisheries habitat in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River.

Alternative C: Direct and Indirect Effects to Populations – Sediment and Channel Forms
As a result of the selection of Alternative C, the direct and indirect impacts to the fisheries habitat variables of sediment and channel forms in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.

4.4.4 Effects on Habitat – Riparian Function, Large Woody Debris, and Stream Temperature

No Action Alternative A: Direct and Indirect Effects to Habitat – Riparian Function, Large Woody Debris, and Stream Temperature

As a result of the selection of Alternative A, there will be no direct or indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Direct and Indirect Effects to Populations – Riparian Function, Large Woody Debris, and Stream Temperature

Critical functions of the stream riparian area include large woody debris recruitment and stream shading. Potential large woody debris recruitment to the channels of fish-bearing streams in the project area is a function of the distance from the stream channel that riparian trees may fall in order to contribute large woody debris. This distance from the stream channel is generally equal to the mean height of dominant and co-dominant trees (Robinson and Beschta 1990, Bilby and Bisson 1998), which is usually expressed as the site potential tree height. Direct solar radiation is the primary mechanism affecting positive changes in stream temperature throughout the project area. Increases in stream temperature can then consequently occur through the loss of riparian vegetation, which intercepts solar radiation. The amount of riparian vegetation intercepting solar radiation, or stream shading, depends on many factors such as width of the stream channel, site potential tree height of dominant and co-dominant riparian tree species, angular canopy density, and stream azimuth.

The proposed actions of Alternative B include timber harvest (Unit K1) immediately adjacent to approximately 2,180 feet of Krause Creek. The proposed timber harvest would take place primarily along the south and east banks of Krause Creek. The harvest prescription for the Krause Creek riparian area includes implementation of the Streamside Management Zone Law and Rules for Class 1 streams and Forest Management Administrative Rules for fish-bearing bearing streams. With respect to the Existing Conditions described in Section 3, there is expected to be a low direct and indirect impact to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Krause Creek as a result of the selection of Alternative B. Although there is expected to be a low impact to these variables, the management prescription for the riparian area is considered adequate due to the extremely limited use of this reach of Krause Creek by non-native fish species.

The proposed actions of Alternative B include timber harvest (Unit BC1) immediately adjacent to approximately 640 feet of Birch Creek. The proposed timber harvest would take place primarily along the north and south banks of Birch Creek. The harvest prescription for the Birch Creek riparian area includes (1) creating a no-cut buffer from the nearest bankfull edge of the stream channel out to 25 feet and (2) harvesting a maximum of 50 percent of trees greater than 8 inches in diameter at breast height from 25 feet out to 101 feet (measured site potential tree height). As a result of the selection of Alternative B, there is a very low risk of measurable or otherwise detectable direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Birch Creek beyond those described in the Existing Conditions.

The proposed actions of Alternative B include timber harvest (Unit BL2) immediately adjacent to approximately 880 feet of Wolf Creek. The proposed timber harvest would take place primarily along the north and west bank of Wolf Creek. The harvest prescription for the Wolf Creek riparian area includes (1) creating a no-cut buffer from the nearest bankfull edge of the stream channel out to 25 feet and (2) harvesting a maximum of 50 percent of trees greater than 8 inches in diameter at breast height from 25 feet out to 91 feet (measured site potential tree height). As a result of the selection of Alternative B, there is a very low risk of measurable or otherwise detectable direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Wolf Creek beyond those described in the Existing Conditions.

The proposed actions of Alternative B include timber harvest (Unit SR1) immediately adjacent to approximately 3,825 feet of the Swan River. The proposed timber harvest would take place primarily along the south and west bank of the Swan River. The harvest prescription for the Swan River riparian area includes the creation of a no-cut buffer from the nearest bankfull edge of the stream channel out to 50 feet. Although shading along the Swan River has a relatively small effect on river temperature, shading by trees within 40 to 50 feet of the river were found to be an important source of in-stream cover within the project area during fields surveys by DNRC

personnel (May 2005). The no-cut buffer is also expected to provide a large portion of the potentially recruitable large woody debris to the Swan River adjacent to the proposed harvest unit. As a result of the selection of Alternative B, there is a low risk of direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in the Swan River beyond those described in the Existing Conditions.

The proposed actions of Alternative B do not include timber harvest within 115 feet of Echo Creek, Noisy Creek, lower Rocky Creek, Bear Creek, Peterson Creek, and Patterson Creek. As a result of the selection of Alternative B, there is not expected to be any measurable or otherwise detectable direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in these streams beyond those described in the Existing Conditions.

Furthermore, the implementation of the Streamside Management Zone Law and Rules on all non-fish bearing Class 1, Class 2, and Class 3 streams within the project area is expected to mitigate any adverse impacts to the variables of riparian function, large woody debris, and stream temperature in these streams. These prescriptions for non-fish bearing streams are consequently expected to mitigate any adverse impacts to fish-bearing streams from upstream tributaries.

Alternative C: Direct and Indirect Effects to Populations – Riparian Function, Large Woody Debris, and Stream Temperature
As a result of the selection of Alternative C, the direct and indirect impacts to the fisheries habitat variables of riparian function, large woody debris, and stream temperature in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.

4.4.5 Effects on Habitat – Connectivity

No Action Alternative A: Direct and Indirect Effects to Habitat – Connectivity
As a result of the selection of Alternative A, there will be no direct or indirect impacts to the fisheries habitat variable of connectivity in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Direct and Indirect Effects to Populations – Connectivity
As part of Alternative B an existing, failed road-stream crossing of Birch Creek (SE1/4 NW1/4 T27N R19W Section 2) would be replaced with a temporary bridge. An existing native materials bridge crossing of Patterson Creek (NW1/4 SE1/4 T27N R19W Section 36) would be supplemented with a temporary bridge. These two bridge structures would be expected to provide naturally occurring levels connectivity to all life stages of native and non-native fish species in Birch Creek and Patterson Creek.

As a result of the selection of Alternative B, there is not expected to be any direct or indirect impacts to the fisheries habitat variable of connectivity in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions.

Alternative C: Direct and Indirect Effects to Populations – Connectivity
As part of Alternative C an existing native materials bridge crossing of Patterson Creek (NW1/4 SE1/4 T27N R19W Section 36) would be replaced with a temporary bridge. The bridge structure would be expected to provide naturally occurring levels connectivity to all life stages of native and non-native fish species in Patterson Creek.

As a result of the selection of Alternative C, there is not expected to be any direct or indirect impacts to the fisheries habitat variable of connectivity in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions.

4.4.6 Cumulative Impacts on Fisheries

No Action Alternative A: Cumulative Impacts to Fisheries
As a result of the selection of Alternative A, there will be no cumulative impacts to the fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described under Existing Conditions.

Alternative B: Cumulative Impacts to Fisheries
Cumulative impacts are those collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (75-1-220, MCA). Future actions include state-sponsored actions that are under concurrent consideration by any state agency through environmental analysis or permit processing procedures. The potential cumulative effects to fisheries in the Foothills Timber Sale project area are determined by assessing the collective anticipated direct and indirect impacts, other related existing actions, and future actions affecting the fish-bearing streams in the project area. In order to help convey a summary of potential cumulative impacts, a matrix of anticipated effects to fisheries in the project area is displayed in Table 4-11.

In order to correctly interpret the potential for cumulative effects in this fisheries analysis, the anticipated cumulative effect to a specific stream is relative to the Existing Conditions. For instance, there is likely an existing 'moderate' level of cumulative effects to fisheries in Krause Creek (see Chapter 3). As a result of the selection of Alternative B, there is a potential 'low' level of cumulative effects that may occur in addition to the 'moderate' level of cumulative effects to fisheries that currently exists.

Other related actions that are considered in the existing cumulative impacts are a low impact to Krause Creek due to off-road vehicle use and a low to moderate impact to the Swan River due to recreational fishing and riparian harvest on other land ownerships in the project area.

TABLE 4-11: Matrix of collective direct, indirect, and cumulative impacts to fisheries in the Foothills Timber Sale project area as a result of the selection of Alternative B.

	Potential impacts to fisheries in the project area from Alternative B							
	Presence and Genetics	Flow Regimes	Sediment	Riparian Function, etc	Connect-ivity	Other Related Actions	Future Actions	**Cumulative Effects**
Krause Creek	None	Low	Low	Low	None	Low	None Known	**LOW**
Echo Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Noisy Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Lower Rocky Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Birch Creek	None	Low	Low	Very Low	None	None Known	None Known	**LOW**
Wolf Creek	None	Low	Low	Very Low	None	None Known	None Known	**LOW**
Bear Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Peterson Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Patterson Creek	None	Low	Low	None	None	None Known	None Known	**LOW**
Swan River	None	Low	Low	Low	None	Low/ Moderate	None Known	**LOW**

The determination of cumulative effects in this fisheries analysis is based on an assessment of all variables, but the variables are not weighted equally in making the determination. Anticipated impacts from sedimentation and connectivity tend to have a greater level of risk to fisheries than the anticipated impacts from flow regimes and riparian function. As a result of these considerations, determinations of foreseeable cumulative impacts in this analysis are primarily a consequence of potential sedimentation related to flow regimes and short-term effects of road improvements.

As a result of the selection of Alternative B, there is likely a low risk of cumulative impacts to fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River beyond those described in the Existing Conditions.

Alternative C: Cumulative Impacts to Fisheries

As a result of the selection of Alternative C, the cumulative impacts to the fisheries in Krause Creek, Echo Creek, Noisy Creek, lower Rocky Creek, Birch Creek, Wolf Creek, Bear Creek, Peterson Creek, Patterson Creek, and the Swan River are expected to be the same as those described for Alternative B.

Potential Timber Conservation License

An application has been submitted for a 'timber conservation license in lieu of sale' within the Bear Creek drainage (M. Friedland, 06/07/05). The potential timber conservation area is approximately one acre in size within proposed harvest unit B1 and approximately 1,400 feet from Bear Creek. Due to the location and minor extent of the timber conservation area, neither positive nor negative foreseeable impacts to fisheries resources in Bear Creek would be expected to occur if the 'timber conservation license in lieu of sale' is accepted. Therefore, as a result of the acceptance of the 'timber conservation license in lieu of sale' and the selection of Alternative B there are not expected to be any additional direct, indirect, or cumulative impacts to fisheries presence, genetics, or habitat variables in Bear Creek.

4.5 PREDICTED EFFECTS ON WILDLIFE

The discussion in this section pertains to potential effects to wildlife species and their habitat due to each alternative. This discussion occurs at 2 scales. The project area includes DNRC-managed lands within Sections 21, 27, 28, and 34 in T27N, R19W, and Section 1-3, 10, 11, 14, 23, 24, 35 and 36 in T28N, R19W. Full descriptions of the project area and proposed harvest units are presented in CHAPTER II – ALTERNATIVES (Figures 2-1 and 2-2). The second scale relates to the surrounding landscape for assessing cumulative effects. This scale varies according to the species being discussed. In this analysis, cumulative effects will be discussed qualitatively, with an explanation of how the lands in question fit into the surrounding habitats and what that means to the wildlife species being discussed. In the cumulative-effects analysis area, the project area and the effects are placed in a landscape context.

Methods

In the effects analysis, changes in the habitat quality and quantity from the existing conditions were evaluated and explained. Specialized methodologies are discussed under the species in which they apply.

Coarse-Filter Assessment

4.5.1 Patch Size and Interior Habitats

Several terms were defined to describe stands for these analyses. Those definitions are:

- "Semi-closed and closed canopy forested habitats" were defined as stands greater than 40 years old (pole- to sawtimber-sized stands) with an overstory canopy cover of 40 percent or more.
- "Edge" habitat was defined as the contact zone between Semi-closed and closed canopy forested and open habitats. For this analysis, the first 300 feet of a patch was considered edge habitat.
- "Interior" habitat was defined as semi-closed and closed canopy forested habitat that was at least 300' from the contact zone of semi-closed and closed forested and open habitats.

No Action Alternative A – Direct and Indirect Effects to Patch Size and Interior Habitats

Under this alternative, the amount, structure, and distribution of semi-closed and closed canopy forested habitat would not be altered. Nine patches ranging from 10 to 2,510 acres in size with a median of 177 acres would be retained. Of these 9 patches, 5 would be greater than 100 acres.

No Action Alternative A – Cumulative Effects to Patch Size and Interior Habitats

Semi-closed and closed canopy forested habitats in the project area and the surrounding National Forests are expected to be retained, while human development is expected to continue to remove semi-closed and closed canopy forested habitat on adjacent private land ownership. Interior habitat would remain in the project area and on USFS Lands while edge habitat would continue to be developed along private land borders. Therefore, habitat for species that use semi-closed and closed forest and interior habitats would be relatively unchanged within the project area, while edge habitat would continue to develop along private land boundaries.

Alternative B – Direct and Indirect Effects to Patch Size and Interior Habitats

Under this alternative, 1,468 acres are proposed for harvest. Of these acres, 1,424 acres of semi-closed and closed canopy forested habitat would be harvested. The overstory removal harvests (44 acres) would not affect patch size or semi-closed and closed forest habitats. The proposed harvesting would result in 10 patches (>5 acre) ranging from 10 to 2,107 acres, with a median of 112 acres. Of these 10 patches, 5 would be more than 100 acres. The proposed harvests would increase the number of patches, but would not reduce the number of larger patches.

The juxtaposition of these patches also affects edge and interior habitat. This alternative would reduce interior habitat by 912 and increase edge habitat by 113 acres (Table 4-12). The harvest prescriptions would reduce canopy closure to less than 40% on 843 acres, thereby increasing open habitats by the same amount. These acres would no longer provide interior semi-closed and closed canopy forested habitat. Therefore, this alternative would reduce habitat for forest species that use semi-closed and closed canopy habitats and interior wildlife species, while increasing habitat for wildlife species that use open and edge habitat. Open habitats are expected

to regenerate in 40-60 years to provide Semi-closed and closed forested habitats, but with a higher proportion of shade-intolerant tree species in these stands.

Alternative C – Direct and Indirect Effects to Patch Size and Interior Habitats

This alternative proposes harvesting 1,156 acres. Of these acres, 1,112 acres of semi-closed and closed canopy forested habitat would be harvested. The overstory removal harvests (44 acres) would not affect patch size or semi-closed and closed forest habitats. The proposed harvesting would result in 10 patches (>5 acre), ranging in size from 10 – 2,350 acres, with a median of 112 acres. Of these 10 patches, 5 would be more than 100 acres. The proposed harvests would increase the number of patches, but would not reduce the number of larger patches.

The juxtaposition of these patches also affects edge and interior habitat. This alternative would reduce interior habitat by 513 and increase edge habitat by 20 acres (Table 4-12). The harvest prescriptions would reduce canopy closure to less than 40% on 531 acres, thereby increasing open habitats by the same amount. These acres would no longer provide interior semi-closed and closed canopy forested habitat. Therefore, this alternative would reduce habitat for forest species that use semi-closed and closed canopy habitats and interior wildlife species, while increasing habitat for wildlife species that use open and edge habitat. Open habitats are expected to regenerate in 40-60 years to provide Semi-closed and closed forested habitats, but with a higher proportion of shade-intolerant tree species. These effects are expected to be less than under Alternative B.

Alternative B and C – Cumulative Effects to Patch Size and Interior Habitats

Under this alternative, forest and interior habitats would be reduced in the project area. These effects would combine with continued rural residential development to reduce semi-closed and closed canopy forested habitat in the Foothills area. Semi-closed and closed forested habitat is expected to be retained and continue to develop on adjacent USFS lands. In the lower elevations, the proposed harvests would contribute to the reduction in semi-closed and closed canopy forest and interior habitat on private lands, resulting in increased amounts of open and edge habitat. In the higher elevations, these effects would be reduced due to retention of semi-closed and closed forested habitats on USFS lands. The effects of this alternative would be less than under alternative B.

Table 4-12. Acres of open, edge, and interior habitats expected following implementation of each alternative.

		Semi-closed and closed canopy forested habitat		
Alternative	**Open Habitat**	**Edge Habitat***	**Interior Habitat**	**Project Area**
A	835 (17.1%)	1,580 (32.3%)	2,472 (50.6%)	4,887 (100%)
B	1,634 (33.4%)	1,693 (34.6%)	1,560 (31.9%)	4,887 (100%)
C	1,328 (27.2%)	1,600 (32.7%)	1,959 (40.1%)	4,887 (100%)

*When buffering for edge habitat, buffers were generated along ownership breaks to capture the potential effects from adjacent lands. Approximately 196 acres of edge habitat abuts National Forest Service forested lands.

4.5.2 Connectivity

No Action Alternative A – Direct and Indirect Effects to Connectivity
Under this alternative, the amount and distribution of forested connectivity would not be altered. The current condition appears to allow relatively unrestricted connectivity through the project area.

No Action Alternative A – Cumulative Effects to Connectivity
The connectivity through the project area would not be altered. However, habitat on adjacent private lands could be reduced by development and/or timber harvests, while semi-closed and closed canopy forested habitat on USFS lands is expected to be retained. Connectivity between the USFS lands and the valley bottom would not be affected.

Alternative B and C – Direct and Indirect Effects to Connectivity
Along the major creeks (Krause, Birch, and Wolf Creeks) that run through proposed harvest units, full retention of existing trees would occur from the bankfull edge out to 25 feet. In addition to the 25 foot no harvest buffer, 65 foot (Krause Creek), 66 foot (Wolf Creek), and 76 foot (Birch Creek) buffers would be established. In these buffers, 50% of the trees 8" or greater dbh would be harvested. For the Swan River, a 50' no harvest buffer would be established with an additional 43 foot buffer in which 50% of the trees greater than 8" dbh would be retained. Additionally, submerchantable trees and shrubs would be protected to the fullest extent possible (ARM 36.11.305 (2)(a)(ii)). Based on the prescription, it is likely that 40% or greater canopy cover would be retained within 90-100' of the streams. Additionally, no harvest units straddle these streams, therefore connectivity could be retained along the opposite bank of the stream corridor. Both alternatives retain connectivity along the major stream courses, across drainages, and in the unharvested and commercially thinned uplands (Figures 4-1 and 4-2). Neither alternative B or C are expected to substantially affect connectivity through the project area. Therefore, animals that need semi-closed and closed canopy forested habitats to meet their life requirements and travel could continue to use interconnected patches of habitat and move through the project area.

Alternative B and C– Cumulative Effects to Connectivity
Connectivity through the project area could be altered on the uplands by the proposed harvests. However, connectivity would be retained along the major stream courses and in unharvested uplands. Continued habitat modification on adjacent private lands could inhibit connectivity from the project area to areas lower on the valley floor. However, connectivity from USFS lands into and through the project area appears to be retained under these alternatives. Therefore, animals that need semi-closed and closed canopy forest habitats should be able to traverse and/or use the project area. In addition, the project area would continue to provide travel habitat between the upper elevations to the valley. However, once wildlife species move through the project area to the valley, they would encounter human development, which would have decreased native habitats and increased mortality risk due to human-wildlife conflicts.

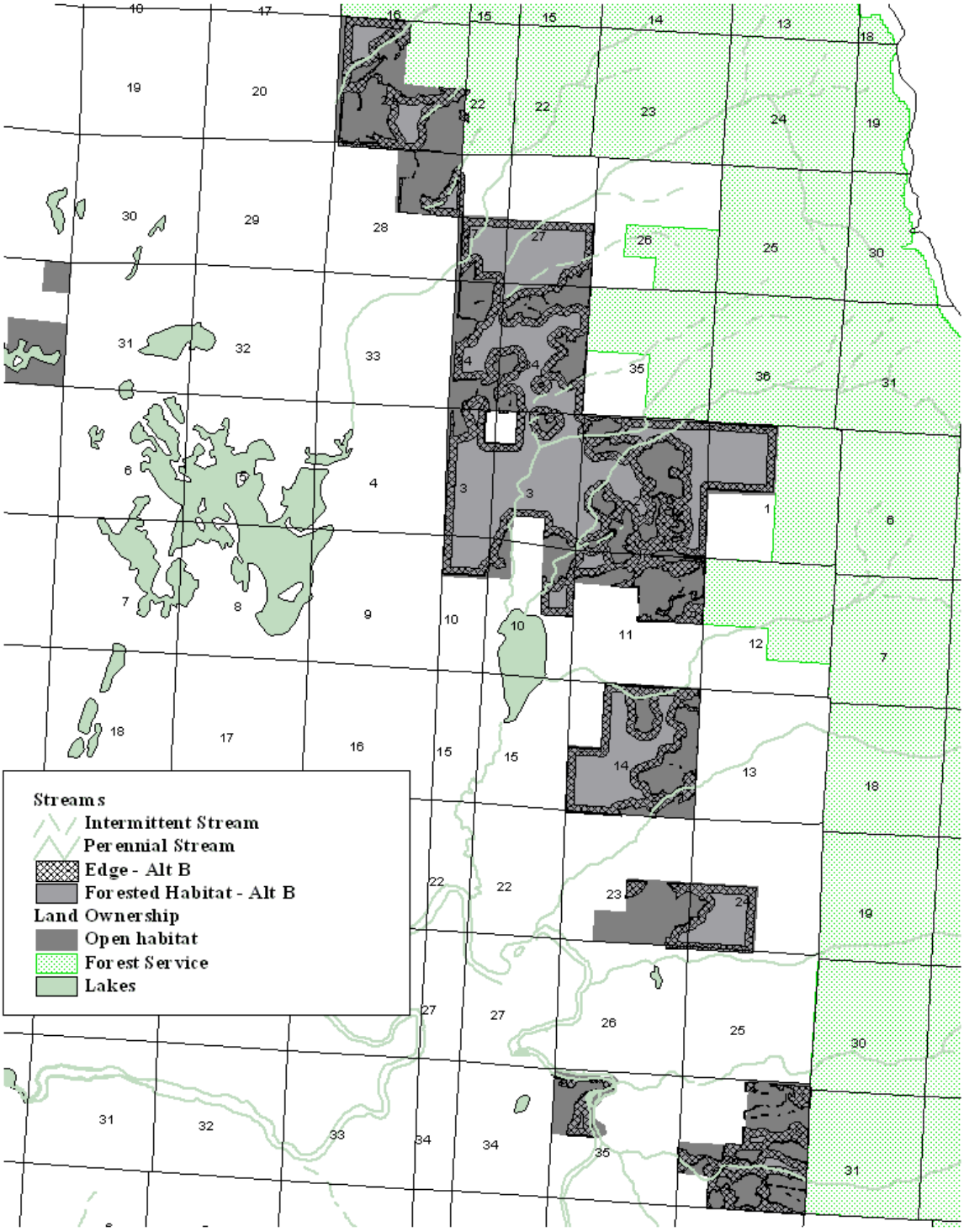
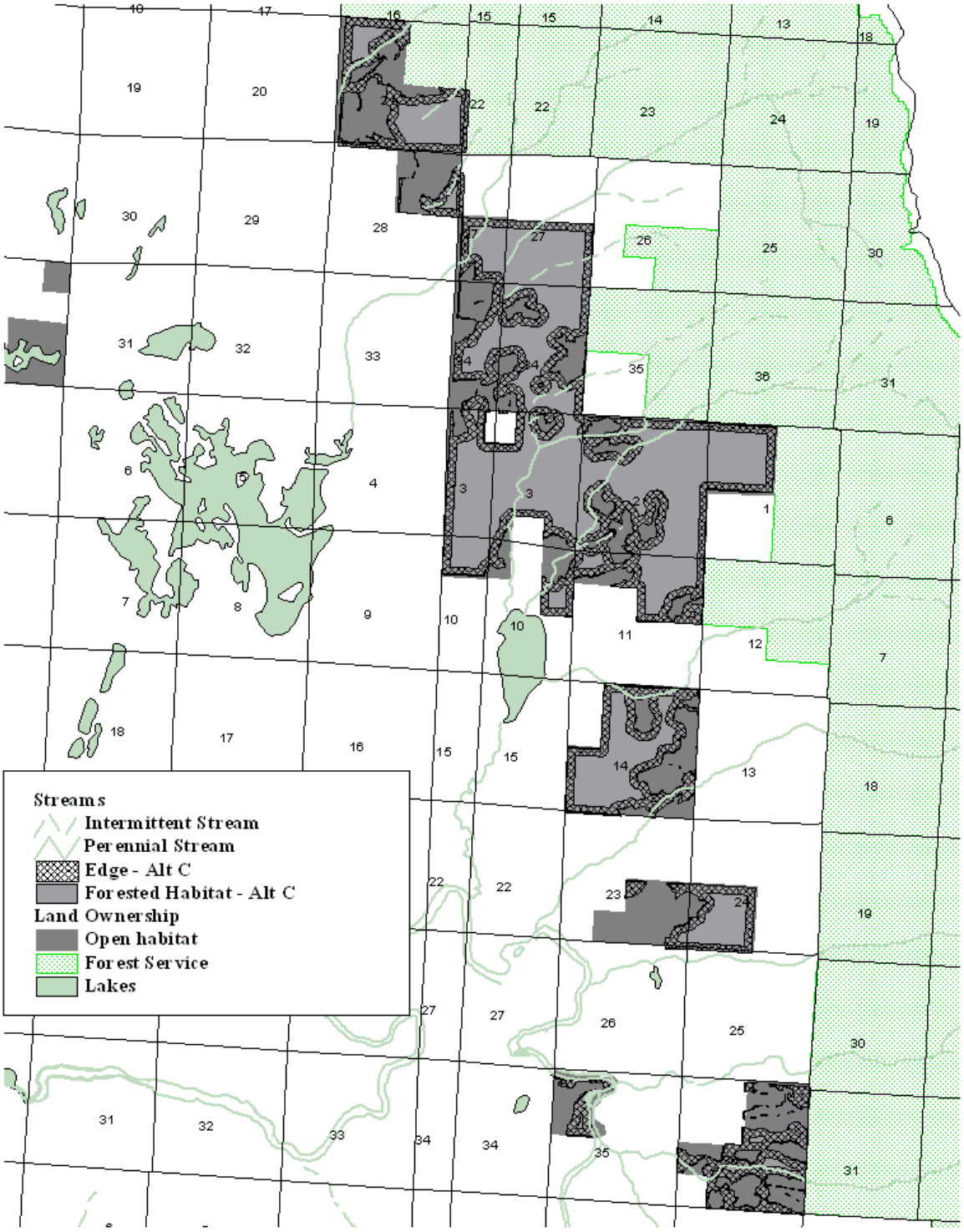


Figure 4-1. Semi-closed and closed canopy forested, interior, and edge habitat remaining following implementation of Alternative B



.

Figure 4-2. Semi-closed and closed canopy forested, interior, and edge habitat remaining following implementation of Alternative C.

4.5.3 Dead Wood Resources

No Action Alternative A – Direct and Indirect Effects to Dead Wood Resources
Under this alternative, the density of existing snags and logs would be retained, with low, long-term retention of shade-intolerant species expected along open and illegally used roads. Currently, many snags are of poor quality because they are predominantly grand fir and other shade tolerant species that possess relatively poor structure for cavity nesting species compared to snags of shade intolerant species, such as western larch. The existing high proportion of poor quality snags, especially grand fir, and low proportion of high quality snags would be perpetuated, with larger shade-intolerant individual trees declining over time with replacement only occurring in currently regenerating stands.

The situation described above would continue to provide habitat for wildlife species that use small to medium snags. Many of these snags would be shade-tolerant species, which provide primarily foraging habitat. Conversely, snags of shade-intolerant tree species would continue to decline due to the lack of regeneration of younger trees of these species. These shade-intolerant-species snags tend to stand for long periods of time. Since most cavity nesting birds excavate several new cavities annually (National Audubon Society 2001), the presence of long standing snags would offer more available cavities for secondary cavity users. Through time, quality nesting structure and available cavities are expected to decline, while poorer quality nesting structure would remain constant or increase. Additionally, foraging structure is expected to increase. Cavity nesting birds are expected to continue to use the area, but reproduction and populations could be reduced due to lower quality nesting structure. The number of cavities available for secondary cavity nesters is expected to decline due to the gradual expected increase in shade-tolerant species snags and reduction of more persistent snags of shade-intolerant species.

The current species mix of snags provides primary and secondary cavity nesting species with habitat structure, but limited nesting sites. The current size class distribution of snags indicates greater habitat for those species that use smaller diameter snags and lesser habitat for species that use large snags over conditions expected in unharvested stands (Harris 1999).

Presently, downed wood is patchy throughout the project area. The closer to roads, the less downed wood is available. Low existing downed wood levels are presumably attributable to firewood gathering. The material that is available is primarily downed trees or broken tops. These materials provide cover for a variety of small mammals and foraging sites for insectivorous birds and mammals. Short-term changes in the availability of this material are not expected from this alternative, however, over time additional downed wood is expected to accumulate, resulting in increased habitat structure.

No Action Alternative A – Cumulative Effects to Dead Wood Resources
Firewood cutting would likely continue. These activities would be expected where motorized access currently exists or where new roads are illegally pioneered. Snags would continue to be removed from the area, with higher snag losses occurring near open and illegally used roads. Subsequently, downed woody debris would follow the same trend. Many of these snags would be shade-intolerant species as they are preferred for firewood, thereby increasing the rate of the decline in nesting structure and the availability of cavity habitat. However, some benefit is gained under this alternative due to the concealment of snags and the obstruction of motorized use by the existing forest structure. The trees and associated obstructions probably reduce losses due to unauthorized firewood cutters.

On adjacent private lands, continued development is expected to exacerbate a decrease in snags and downed logs over time due increasing localized demands for firewood. On USFS lands surrounding the project area, snags and downed logs are expected to follow the trends described under the No Action Alternative above. Cumulatively, snag and CWD amounts are expected to follow the trend discussed in the direct and indirect effects on managed lands with decreases in snags and downed logs on adjacent lands that experience human development.

Alternative B – Direct and Indirect Effects to Dead Wood Resources
Under this alternative, harvests would occur on 1,468 acres of land in the project area and snag densities would be reduced to approximately 2 snags/acre and 2 snag recruitment trees (ARM 36.11.411 (1)(a)). In the reconnaissance plot sampling (Table 3-12), no stand showed an average of greater than 2 snags >21” dbh,

therefore large snags are expected to be retained near their existing densities, while the smaller snag densities would experience declines. Ponderosa pine, western larch, and Douglas-fir snags would be favored for retention. Other species of snags could be retained if adequate numbers of the preferred species were unavailable. Most of the smaller snags (primarily shade-tolerant species) would be harvested for lumber and/or pulp. Trees with mistletoe would be harvested, regardless of their value for snag recruitment. Several large western larch trees with mistletoe were observed in the project area. These trees tend to be relatively rare in the project area and have high value for cavity habitat, but would be removed to prevent mistletoe infection.

Under this alternative, snag habitat is expected to decrease. Snag retention would meet ARM 36.11.411 (1)(a), but decreases in the density of medium (15-21" dbh) and small (8-15" dbh) size classes would occur. The retention of 2 snags/acre (> 21" dbh) approximates the densities found on uncut sampling plots in these habitat type groups (Harris 1999). In most stands, the density of large snags is less than 2 snags/acre, therefore snags of the next largest size class would be used to meet ARM 36.11.411. Many cavity nesting species use snags less than 21" dbh for nesting and foraging. Additional snags of desired species and/or heavily used snags, along with broken topped trees, non-commercial tree species or trees with high defect would be retained consistent with ARM 36.11.413(1). Along with the retention of snags, 10-15 tons of coarse woody debris per acre would be retained. Approximately, 5 tons would be tree boles and butts.

The density of smaller snags would differ from the densities reported by Harris (1999). The density of snags of all sizes tends to correlate with the richness and abundance of birds (Dickerson et al. 1983, Scott 1979). Many of the snags expected to be harvested are grand fir and/or are in the smaller size classes. These trees provide primarily foraging structure for cavity nesting birds. If additional snags in a variety of size classes were retained, more habitat structure would be retained to provide foraging and nesting sites for cavity nesting birds. However, the nesting structure would likely be of lower quality. Also, adjacent unharvested stands could provide foraging sites thereby offsetting some losses of foraging structure expected to occur within the harvest areas. The loss of small to medium-sized snag habitat is expected to last for approximately 50-100 years in regenerated units. In commercially thinned and shelterwood harvest units, the effects of the loss of foraging sites is expected to be less due to the higher rate of retention of tree that could provide foraging sites in the near future. In the distant future, this alternative is expected to result in increased nesting structure as the regenerating trees age and die. Overall, species associated with snag habitat in closed canopy stands are expected to decline in the project area in response to this alternative. Species associated with snag habitat in open canopy forested conditions are expected to increase, but to a lesser extent than if a full complement of historic snag densities and size classes were retained.

Snag retention would occur in a variety of configurations. A combination of grouping and dispersing of snags throughout the harvest units would occur. This configuration provides a variety of habitat structures and densities. Grouping snags tends to retain habitat characteristics that favor primary cavity nesting birds, while distributed snag habitat tends to benefit secondary-cavity nesting birds (Bunnell et al. 2002).

Alternative B – Cumulative Effects to Dead Wood Resources

In addition to the harvest of snags, motorized access could affect snag retention through firewood removal. In this alternative, open road density reductions and reinforcement of closure devises are planned. If these road systems were successfully restricted, minimal additional snag loss would be expected away from open roads. However, due to the topography and persistence of unauthorized motorized recreationists, closure breeching could occur. Additionally, the harvesting of trees would increase the visibility of snags and reduce obstacles to pioneering new roads, resulting in an increased risk of additional snag losses. Clumping snag retention patches in areas were motorized access is difficult and/or where snags are concealed from open roads could reduce the risk of additional snag losses. However, this strategy could reduce the benefits for wildlife species associated with snag habitat in areas away from these retention patches.

On adjacent lands, continued private development is expected to decreased snags and CWD and increased numbers of people in the area that might want to cut firewood regularly to heat homes. Snag and coarse woody debris levels on USFS lands surrounding the project area are expected to follow the trends discussed under the No Action Alternative. Cumulatively, structure associated with dead wood is expected to follow the trend discussed in the direct and indirect effects on DNRC lands with decreases in habitat on developing private lands.

Alternative C – Direct and Indirect Effects to Dead Wood
This alternative proposes to harvest on 1,156 acres with the same snag retention requirements and road density reductions as stated above for Alternative B. The effects discussed under Action Alternative B would be expected under this alternative, but to a lesser degree due to the reduced harvest area.

Alternative C – Cumulative Effects to Dead Wood
The cumulative effects are expected to be the same as those described under Action Alternative B, except that the scope of the effects would be reduced due to the reduction in acres harvested.

Fine Filter
In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species federally listed as threatened or endangered, species listed as sensitive by DNRC (ARM 36.11.436(6)), and species managed as big game by DFWP. These species are addressed below.

Threatened and Endangered Species

4.5.4 Bald Eagle

No Action Alternative A – Direct and Indirect Effects to Bald Eagles
Under this alternative, no changes in the current habitat are expected.

No Action Alternative A – Cumulative Effects to Bald Eagles
Continued illegal motorized access and firewood cutting would occur, thereby decreasing bald eagle perching structure in the project area. Human developments would also continue to decrease eagle habitat and increase disturbance on private lands.

Alternatives B and C – Common Direct and Indirect Effects to Bald Eagles
Under these alternatives, harvest activities would occur on approximately 356 acres of 12,560 acres (2.8%) within the Echo Lake territory and 310 acres of 12,560 acres (2.5%) within the Ferndale bald eagle territory Proposed harvest prescriptions would retain dominant trees, large snags, and snag recruitment trees in the harvest units, therefore a majority of perch sites are expected to be retained. The 50' no harvest buffer along the Swan River in the Ferndale territory would retain all perch and potential nest sites adjacent to the river. The reduction in tree canopy in the project area could also increase an eagle's ability to reach the ground to hunt rodents or take advantage of carrion. Overall, this alternative is expected to result in minor positive effects to bald eagles.

Alternatives B and C – Common Cumulative Effects to Bald Eagles
In addition to the proposed harvests, retention trees could be illegally harvested due to access and detection of retention trees in the harvest units. If the planned road closures were successful, these effects would be minor and only be possible near open roads. If closure devices cannot be effectively maintained, more large trees and snags could be lost through firewood cutting. Development on adjacent lands is expected to decrease habitat structure and increase human disturbance, which could adversely affect foraging eagles. Cumulatively, the proposed harvest units are not likely to affect eagle use or reproductive success of either territory. Therefore this project is expected to negligibly affect bald eagles.

4.5.5 Gray Wolf

No Action Alternative A – Direct and Indirect Effects to Gray Wolves
Under this alternative, the current distribution of cover and relatively unrestricted motorized access would continue. The current level of motorized access probably reduces the potential use of the project area by wolves. However, the current high amounts of hiding cover in the area could provide security for wolves in the project area to offset some of the effects of the high levels of motorized use.

No Action Alternative A – Cumulative Effects to Gray Wolves
Under this alternative, the current amount of hiding cover and high amount of motorized access would persist. Low habitat security on adjacent private lands reduces the potential for wolves to colonize and successfully inhabit the cumulative effects area.

Alternative B - Direct and Indirect Effects to Gray Wolves
Under this alternative, hiding cover would be reduced in all regeneration units (843 acres) of the 4,887-acre project area (17.3%) and open road densities would be reduced from 3.6 to 3.1 miles/sq. mile. Motorized disturbance in the area is expected to be decreased further by reinforcing existing closure devises. The long-term success of these closures is uncertain given the current levels of illegal motorized use. The installation and reinforcement of closure devises would serve to inform to the public that motorized use is not allowed on that road system. In addition, several signs showing the motorized access management in the area would be posted at designated parking locations.

The reduction in hiding cover could increase the risk of mortality to wolves. The openings produced by the timber harvests would increase the visibility of wolves, if they move into the area. The increased visibility could result in increased human-caused mortality due to misidentification of wolves as coyotes, perceived or real threat to life or property, or malicious intent of people who do not want wolves in the area. The visibility of wolves would be mitigated by the retention of visual screening along open roads (ARM36.11.433 (1)(b)), and hiding cover in riparian areas (ARM 36.11.433 (1)(c)). In addition, vegetation components may be retained in select areas where human use is high. Incorporating these mitigations into the project design would result in minor negative, short-term effects to wolves under this alternative. These effects are expected to last until hiding cover or visual screening redevelops in the regeneration units (approximately 6-10 years).

Under this alternative, reduced motorized access and disturbance is expected to increase security for wolves and their prey in the project area, if road restrictions are successful. The loss of hiding cover and visual screening would reduce security for wolves in the area for approximately 6-10 years, but greater restrictions on motorized access could offset some of these effects. Use of the project area or population numbers of big game species, the main prey for wolves, are not expected to be substantially affected by this alternative (refer to Big Game analysis). Overall, this alternative is expected to result in minor increases in the risk of mortality for wolves in the short-term should wolves show up in the project area vicinity. In the longer-term, this alternative is expected to result in moderately beneficial effects if road closures are effective and hiding cover or visual screening is re-established as exoected.

Alternative C - Direct and Indirect Effects to Gray Wolves
The effects discussed under alternative B are expected under this alternative, also, but to a lesser degree due to the reduced harvest areas. The effects related to motorized access would apply directly to this alternative since the motorized access plan is the same under both alternatives.

Under this alternative, hiding cover would be reduced in all regeneration units (843 acres) of the 4,887-acre project area (10.9%) and open road densities would be reduced from 3.6 to 3.1 miles/sq. mile. Motorized disturbance in the area is expected to be decreased further by reinforcing existing closure devises. The long-term success of these closures is uncertain given the current levels of illegal motorized use. The installation and reinforcement of closure devises would serve to inform the public that motorized use is not allowed on that road system. In addition, several signs showing the motorized access management in the area would be posted at designated parking locations.

Alternative B and C– Cumulative Effects to Gray Wolves
Wolves generally den on big game winter ranges. A majority of the big game winter range associated with this project occurs at lower elevations in the cumulative effects area. The reduction of hiding cover proposed under this alternative and the heavy human use in and around the project area combine to reduce the potential for wolf denning in the short-term (Less than 6-10 years). With increased security in the project area resulting from the proposed motorized access restrictions, wolf denning potential could increase over the long-term (over 6-10 years). However, the increase in potential denning security could be offset by high amount of human use and development in the adjacent areas. Overall, the effects of this project are expected to reduce wolf security in the short-term, while increasing security in the long-term by reducing motorized access. This alternative is not expected to appreciably effect wolf denning habitat or wolf use of the cumulative effects analysis area. Because less area would be harvested under alternative C, the short-term effects of alternative C would be less than under alternative B.

4.5.6 Grizzly Bear

No Action Alternative A - Direct and Indirect Effects to Grizzly Bears
Under this alternative, the current amount of hiding cover and foraging areas would persist. Illegal motorized use would continue on the existing roads (approximately 8.7 miles/sq. mile) and pioneering of new roads would likely continue. However, the forested conditions found throughout the project area could deter the pioneering of new roads. The current status would continue to impact grizzly bear security and potential displace bears, resulting in increased mortality risk and energetic costs of bears using the project area.

No Action Alternative A – Cumulative Effects to Grizzly Bears
Under this alternative, the current amount of hiding cover and high amount of motorized access would persist. Habitat security on adjacent private lands remains low, thereby reducing habitat effectiveness of grizzly bears that use the project area. Additionally, the adjacent private lands provide long-term habituation risk that could lead to increased mortality.

Alternative B – Direct and Indirect Effects to Grizzly Bears
Under this alternative, 1,468 acres of the project area would be harvested using prescriptions ranging from clearcuts to selective improvement cuts. Approximately 2.5 miles of the proposed regeneration harvest unit boundaries occur adjacent to private lands. In harvest units where regeneration treatments are proposed (843 acres), hiding cover and visual screening generally would be removed, except visual screening along open roads (ARM 36.11.433 (1)(b)), hiding cover in all riparian zones (ARM 36.11.433 (1)(c)), and vegetation structure in select areas where high human use occur. Site preparation would include machine scarifying openings and spot burning to encourage natural regeneration of shade-intolerant tree species, along with planting nursery stock. In addition, the young trees would be sprayed with blood meal to deter big game browsing. Open road densities would be reduced from 3.6 to 3.1 miles/sq (simple linear density).

The harvest activities could displace grizzly bears (Mace and Jonkel 1980). Bears are especially vulnerable to the effects of reduced foraging time and displacement during the spring period. During the spring period, forage resources are in limited areas. The spring grizzly bear season runs from the time of den emergence to when grizzly bears change diets and behavior patterns. This period is approximately 1 April to 15 July (Waller and Mace 1997). To reduce disturbance to grizzly bears during the critical spring season, no harvest activities would occur between 1 April and 30 June. If bears moved into the project area prior to 1 April, some disturbance could occur if winter harvesting activities are active. However, bears are not expected to move into the project area prior to 1 April (Waller and Mace 1997, T.Manley unpublish data). If bears do show up early, the displacement effects would primarily affect males, because males tend to emerge from their dens earlier than females and females with cubs (Waller and Mace 1997). Additionally, disturbance could occur during the late spring period (1 July-15 July) because bear use of spring habitat could still be occurring. At this time of the season, habitat is more available and the effects of displacement would be lessened. During the summer bears are not expected in the area. In the autumn, some bears move into the project area and onto adjacent lands. During this time period, bears complaints on the adjacent private lands increase (Manley, unpubl. Data). During the summer and autumn periods, displacement of bears could occur, however, if this occurred, other habitat to displace into would be available. Therefore, the effects expected due to displacement and disturbance associated with harvest activities are expected to be minor due to prohibiting harvest activities in the spring and low potential of grizzly bear use and the availability of dispersal areas during the summer and autumn periods.

Harvest treatments under alternative B could affect grizzly bear foraging habitat. Important bear foraging items tend to increase when canopy cover is reduced (Zager 1980). Therefore, it is expected that forage availability would increase in relation to the amount of canopy cover removal. Scarification could affect vegetation response. Plants that spread by seed benefit from scarification and increase in cover, while plants that spread by vegetative propagation often decrease (Zager 1980). In the project area, many of the key bear foods are herbaceous species and spread by seed. Therefore, scarification could further increase forage production. Even if forage production occurs, other factors could affect bear use of harvested units. Zager (1980) and Waller (1992) found that bears generally avoided harvest units during the nondenning season. Waller and Mace (1997) found bears avoided harvest units during the spring and autumn, while showing a strong preference for harvest units in the summer. Some reasons that could reduce use of harvest units include presence of open roads, and presence of better seasonally preferred foraging sites (Waller 1992, Waller and Mace 1997). Clearcuts and younger cutting units

tended to be used less than other cutting units (Waller and Mace 1997). Grizzly bears tended to use 30-40 year old cutting units more often than older or younger units (Waller and Mace 1997). The current amount of bear forage appears to provide adequate forage, therefore the benefits of additional forage production is expected to be minor.

This alternative is expected to reduce motorized access by 14% by reducing simple linear open road densities from 3.6 to 3.1 miles/sq. mile. Motorized disturbance in the area is expected to decrease further by reinforcing existing closure devises. The long-term success of these closures is uncertain given the current levels of illegal motorized use, the flat topography, lack of enforcement, and the high levels of human development surrounding the project area. The installation and reinforcement of closure devises would serve to remind to the public that motorized use is not allowed on that road system. In addition, several signs showing the motorized access management in the area would be posted at several parking locations in the project area. If the closures are effective, grizzly bear disturbance in the area is expected to be reduced, thereby resulting in substantial positive effects. The reduction of disturbance in the area could result in increased foraging time and reduced energetic costs for bears using the project area resulting in decreased mortality and increased reproduction success.

Timber harvests would remove hiding cover and visual screening in harvest units proposed for regeneration harvests (843 acres). The reduction in hiding cover could increase the risk of mortality to grizzly bears. The openings produced by the timber harvests would increase the visibility of bears, which could result in human-caused mortality. Grizzly bear mortality could occur due to misidentification of grizzly bears as black bears during legal hunting seasons, perceived or real threat to human life and property, or malicious intent of people who do not want grizzly bears in the area. The visibility of grizzly bears would be mitigated by the retention of visual screening along open roads (ARM36.11.433 (1)(b)), hiding cover in riparian areas (ARM 36.11.433 (1)(c)), and vegetation components in select areas where high amounts of human use are expected. High amounts of motorized access could exacerbate the risk of mortality associated with increased visibility. If the road restrictions were successful in reducing road disturbance and motorized access, the increased risk of mortality associated with increased visibility would be reduced. The effects associated with reduce hiding cover are expected to last until shrubs and trees regenerate enough to provide hiding cover (approximately 6-10 years, depending on the success of regeneration and shrub sprouting).

Under this alternative, blood meal would be sprayed on regenerating seedling/saplings to deter big game browsing. Blood meal could attract grizzly bears to the regenerating harvest units (T.Manley, FWP, pers. comm. 4/29/05), however, they would not receive a food reward. Similar to attractants used in the Greater Glacier Area Bear DNA Project (Kendall 2004), a bear could be drawn to an area, but is not expected to stay in or defend the area because no food reward would be received. If blood meal were used near private lands, a bear could be attracted to the area, then travel to nearby lands to gain a food reward, if available. However, since bears are commonly in the area, if a nearby private landowner provided unsecured food resources, bears would be expected to find them regardless of the blood meal application. Therefore the effects of the blood meal application are expected to be minor. As seen on the Greater Glacier Area Bear DNA Project (Kendall 2004), bears might roll on the seedlings treated with blood meal. This behavior could result in mortality or deformation of the seedlings. However, if this behavior occurs, it is likely to only affect a small area of regeneration, therefore these effects to regenerating seedlings are expected to be minor.

Overall, the access management planned under this alternative would result in major positive benefits to grizzly bears if the closure devises are effective and new roads are not pioneered. The increase in forage production is expected to result in minor positive effects to grizzly bears. The loss of hiding cover and visual screening due to timber harvests could result in short-term (6-10 years), minor increases in mortality risk or energetic costs of bears using the area. These effects could be offset largely by the proposed access management plan.

Alternative C – Direct and Indirect Effects to Grizzly Bears

Under this alternative, 1,156 acres of the project area would be harvested using prescriptions ranging from clearcuts to selective improvement cuts. Approximately 1.8 miles of the proposed regeneration harvest unit boundaries occur adjacent to private lands. In harvest units where regeneration treatments are proposed (531 acres), hiding cover and visual screening generally would be removed, except visual screening along open roads (ARM 36.11.433 (1)(b)), hiding cover in all riparian zones (ARM 36.11.433 (1)(c)), and vegetation structure in

select areas where high human use is expected. Site preparation would include machine scarifying openings and spot burning to encourage natural regeneration of shade-intolerant tree species, along with planting nursery stock. In addition, the young trees would be sprayed with blood meal to deter big game browsing. Open road densities would be reduced from 3.6 to 3.1 miles/sq (simple linear density).

Overall, the effects discussed under Alternative B would be expected to occur under this alternative also. The effects expected due to access management are the same as Alternative B. The effects expected due to the loss of hiding cover and visual screening are expected to be less than Alternative B due to the reduced area of harvest. The effects associated with the removal of hiding cover and visual screening within the harvest units are expected to last approximately 6-10 years and could be offset largely by the proposed access management plan.

Alternatives B and C – Cumulative Effects to Grizzly Bears
Cumulative effects were qualitatively analyzed using the Noisy Red Owl and Peters Ridge Subunits. Habitat in the project area contributes to the conservation of grizzly bears in the subunits. Although the project area comprises a small portion of the Noisy Red Owl (14.7%) and Peters Ridge (2.8%) Subunits, it lies in important spring habitat. Also, the project area is adjacent to rural residential developments known for bear-human conflicts. Potential effects associated with both proposed action alternatives would be cumulative to lower security and higher mortality risk associated with high human use in the area on neighboring private lands. In the short-term, the proposed project could increase mortality risk in the subunit due to increased visibility of bears, however, reduced motorized access could offset most of this risk. In the longer term, grizzly bears could benefit by the increased security, reduced disturbance, and to a lesser extent, forage production expected under both alternatives.

Sensitive Species

4.5.7 Fisher

No Action Alternative A – Direct and Indirect Effects to Fisher
No changes in fisher habitat are expected, with the project area retaining approximately 4,052 acres of potential habitat. The continued illegal access and firewood cutting would continue to remove snags and downed logs, which are important elements of fisher habitat.

No Action Alternative A – Cumulative Effects to Fisher
The reduction of fisher habitat structure in the project area would be cumulative to reductions likely to occur on private lands in the analysis area. However, travel through the project area from USFS lands through the project area to private lands would not be inhibited.

Alternative B – Direct and Indirect Effects to Fisher
Under this alternative, 1,186 acres of 4,052 acres (29.3%) of fisher habitat in the project area would be converted to unsuitable, while 280 acres (6.9%) of habitat would be modified. Within these harvest units, a minimum of 2 snags and recruitment trees per acre would be retained to provide habitat structure. Additionally, 10-15 tons/acre of coarse woody debris would be retained, with 5 tons occurring in the larger size classes. However, fisher use of clearcut areas or areas with <40% crown closure (Jones 1991) is not expected to occur until the regenerating trees reach approximately 6 feet (6-10 years). In the modified stands, canopy cover would be reduced, therefore fisher use is expected to decline. Retention of large snags would result in approximate density of large snags expected in unharvested stands (Harris 1999), but overall snag densities are expected to decrease. Therefore upland fisher resting and denning structure is expected to decline, resulting in decreased fisher habitat in all units, but allowing travel through the 280 acres of units modified by timber harvests. Harvests within 100' of class 1 streams and within 50' of class 2 streams would likely retain greater than 40% canopy cover after harvest, thereby retaining the existing 89.6% of moderate to well stocked sawtimber stands associated with these stream and meeting ARM 36.11.440 (1)(b)(i).

Alternative C – Direct and Indirect Effects to Fisher
The effects discussed above hold true for this alternative, but would apply to less area. Under this alternative, 879 acres of 4,052 acres (21.7%) of fisher habitat in the project area would be converted to unsuitable, while 276 acres (6.8%) of habitat would be modified. Because less fisher habitat would be removed or modified, this alternative is expected to result in reduced effects to fishers as compared to Alternative B.

Alternatives B and C – Common Cumulative Effects to Fisher
All alternatives would result in retaining >40% canopy cover along streams, which fishers are expected to use for travel through the project area and provide connectivity between USFS lands and private lands in the valley bottom, although habitat in the valley bottom is expected to be limited due to human development and firewood cutting. Firewood cutting would continue to remove important resting/nesting structure. If the road access management plan were effective, additional losses of structure away from open roads would be minimal. However, if the road access is not successful, the vulnerability of these large trees/snags could increase, further decreasing fisher habitat structure. Habitat on neighboring USFS lands is expected to be retained.

4.5.8 Pileated Woodpecker

No Action Alternative A – Direct and Indirect Effects to Pileated Woodpecker
No changes in the amount or distribution of pileated woodpecker habitat are expected. Based on SLI data, approximately 2,418 acres of the project area offers pileated woodpecker nesting habitat. Nesting habitat on these acres is likely of marginal quality due to periodic removal of large snags. The remaining 1,764 acres of semi-closed and closed canopy forested habitat could offer potential foraging habitat. Continued illegal access and associated firewood cutting would continue to remove snags and downed logs which provide important nesting and feeding structure. Over time, shade-intolerant tree species that provide important nesting structure would continue to decline and become more rare in the project area.

No Action Alternative A – Cumulative Effects to Pileated Woodpecker
Continued illegal motorized access and firewood cutting would continue, thereby decreasing pileated nesting structure in the area. Nesting and foraging habitat is expected to be retained on USFS lands surrounding the project area, while habitat on private lands in the area are expected to decline due to reductions in large snags and fragmented habitat caused by rural development.

Alternative B – Direct and Indirect Effects to Pileated Woodpecker
This alternative would reduce pileated nesting habitat by 833 acres in the project area, leaving approximately 1,585 acres (65.6%). In the harvest units, a minimum of 2 snags/acre greater than 21" dbh, if available, would be retained. These snags and trees are expected to provide nesting habit in the developing stand in the distant future. In the shorter term, these snags could provide foraging habitat. However, where clearcut or seedtree (843 acres) harvest prescriptions are planned, pileated woodpecker use of these harvest units is expected to be minimal until canopy cover redevelops in 50-100 years. In the distant future, the regeneration of preferred shade-intolerant tree species on 843 acres could provide nesting habitat structure if these trees attain a large diameter and internal rot providing a long-term benefit to pileated woodpecker habitat.

Alternative C – Direct and Indirect Effects to Pileated Woodpecker
This alternative would reduce pileated nesting habitat by 709 acres in the project area, leaving approximately 1,709 acres (70.7%). The effects discussed above under the alternative B discussion would be expected to occur. Pileated use is expected to be minimal in the short term on these 575 acres on which seed tree and clearcut treatments are planned. In the distant future, the regeneration of shade-intolerant tree species on 575 acres is expected to benefit pileated woodpeckers by provide nesting habitat structure as these trees attain a large diameter and internal rot.

Alternatives B and C – Common Cumulative Effects to Pileated Woodpecker
Continued illegal motorized access and firewood cutting would likely continue, thereby decreasing pileated nesting structure. Nesting and foraging habitat is expected to be retained on USFS lands surrounding the project area, while habitat on private lands in the area is expected to decline due to removal of large trees and snags.

4.5.9 Big Game Species

No Action Alternative A – Direct and Indirect Effects to Big Game Species
Under the no action alternative, no changes in big game use or distribution is expected. The existing 4,197, 90, and 615 acres of thermal cover, semi-closed canopy forest, and openings, respectively, would be retained. Additionally, open road densities of 3.6 miles/sq. mile would persist. The disturbance associated with the illegal motorized use would continue.

No Action Alternative A – Cumulative Effects to Big Game Species
Under this alternative, the current amount of hiding cover and high amount of motorized access would persist.

Alternative B – Direct and Indirect Effects to Big Game Species
Under this alternative, 854 acres of thermal cover would be removed and 554 acres would be reduced to semi-closed canopy forest cover, resulting in approximately 57% of the project comprised of thermal cover with an additional 13% of semi-closed canopy forested habitat. The remaining 30% is in openings that provide forage (Table 4-13). The reduction in thermal and increases in openings is expected to result in minor changes in big game habitat use, but not to affect carry capacity (Table 4-13).

Regeneration harvests (843 acres) would increase the visibility of big game species using the harvest units, thereby increasing their exposure to predators, including hunters. To mitigate big game vulnerability and habitat use, visual screening would be retained along open roads, along riparian features, and in select areas where high amounts of human use are expected. The effects related to the loss of hiding cover is expected to last until the harvest units regenerate enough vegetation to once again provide hiding cover (6-10 years). Controlling motorized access could offset the increased vulnerability of big game due to the loss of hiding cover.

Reductions in open road density are expected to decrease big game disturbance. This alternative would reduce open road densities from 3.6 to 3.1 miles/sq. mile, while attempting to reduce illegal use by reinforcing existing closures. All major roads in the area would remain open to provide motorized access routes for hunters and the general public to access the area. If the access management plan is effective, an increase in vulnerability due to reductions in hiding cover is expected to be minor. If the access management plan is ineffective, the loss of hiding cover could result in reduced big game habitat suitability, and increased vulnerability during hunting season. Elk respond to motorized access more than white-tailed deer, but are more capable of tolerating higher snow accumulations expected where canopy cover was removed. Therefore, elk would respond more positively or negatively to the success of road management, while deer could be more negatively impacted by the habitat modifications resulting by the timber harvests. The effects of these alternatives to big game species are expected to be minor to moderately beneficial if road closures are effective. No appreciable population effects would likely occur at the hunting district level, thus no impacts to hunter opportunity or hunter access would be expected and the number of big game animals using the area would be minimally affected by habitat alterations proposed under these alternatives.

In the regenerating units following harvest, big game browsing could highly impact regeneration of young trees. To reduce browsing, blood meal would be sprayed on the terminal leader for several years following planting. This technique has been successful on other areas in the Kalispell area (B. O'Brien, pers. comm. 5/05). If this technique works, hiding cover is expected to regenerate in 6-10 years. If this technique does not work, DNRC would look at other avenues to successfully regenerate the harvest units.

Alternative C – Direct and Indirect Effects to Big Game
Under this alternative, 531 acres of thermal cover would be removed and 554 acres would be reduced to snow intercept cover, resulting in approximately 63% of the project comprised of thermal cover with an additional 13% of semi-closed canopy forested cover. The remaining 24% is in openings that provide forage (Table 4-13). The reduction in thermal and increases in openings is expected to result in minor changes in big game habitat use, but not effect carry capacity. This alternative would reduce the minor negative effects that white-tailed deer might experience due to the reduction in thermal cover.

Table 4-13. Changes in big game habitat components under each of the proposed alternatives.

Parameter	Alternative A		Alternative B		Alternative C	
	Acres	% Project	Acres	% Project	Acres	% Project
Thermal Cover	4,197	86%	2,800	57%	3,112	63%
Semi-closed canopy	90	2%	644	13%	644	13%
Opening	615	13%	1,458	30%	1,146	23%

Alternatives B and C – Common Cumulative Effects to Big Game
The project area comprises only 21% of the lands in the cumulative effects area. Under both alternatives thermal cover would be reduced in the project area. However, thermal cover on USFS lands would remain, while continued development and clearing activities could reduce thermal cover on private lands. The project area lands lie on the upper portions of white-tailed deer winter range and are not used heavily in years with heavy snow accumulations. In years with heavy snow accumulations, white-tailed deer are expected to be pushed to the private lands in lower elevations. Therefore, the reduced thermal cover on the project area lands is not expected to affect winter range carrying capacity for white-tailed deer. Elk and mule deer tolerate deeper snow depths, therefore they are less tied to thermal cover. Adequate amounts of thermal cover would be retained in the project area and on adjacent USFS lands to provide for wintering elk and mule deer. These alternatives are not expected to alter the carrying capacity of this winter range.

Both action alternatives reduce motorized access in and through the project area. However, main access roads would remain open to provide access points for non-motorized use of the project area and the surrounding lands. The proposed motorized restrictions are not expected to reduce hunter access to the project or surrounding area. These changes in motorized access are expected to offset vulnerability caused be reductions in hiding cover.

4.6 PREDICTED EFFECTS ON AIR QUALITY

The analysis area for air quality includes the Flathead County and Lake County portions of Montana Airshed 2 as defined by the Montana Airshed Group. The methodologies used to analyze effects to air quality include estimating the location, amount, and timing of dust or smoke generated by project –related activities.

No Action Alternative A – Direct, Indirect, and Cumulative Effects to Air Quality
The existing condition would not change under the No Action Alternative in the project area or in Airshed 2.

Alternatives B and C – Common Direct and Indirect Effects to Air Quality
Log hauling and other project related traffic on native surface or gravel roads would increase the amount of road dust produced during dry periods. Post harvest burning associated with slash disposal or site preparation would produce smoke emissions. The increased dust and smoke emissions are not expected to exceed air quality standards, and would be temporary, localized reductions to air quality such as currently occurs. Burning would be accomplished within the requirements imposed by the Montana Airshed Group. Non burning methods such as trampling slash, whole tree skidding in areas immediately adjacent to private property, and removing wood material as pulp would limit the amount of burning that would occur near homes, as well as reducing the amount of slash to be burned. Dust production would be limited or controlled by limiting the amount of hauling that occurs during dry periods, maintaining low speeds, and applying dust abatement to roads during dry periods.

While both Alternative B and Alternative C would temporarily increase the amount of smoke and dust produced in the project area, Alternative B's increase would be slightly higher in the north half of the project area.

Alternatives B and C – Common Cumulative Effects to Air Quality
Dust and smoke produced from implementing either Action Alternative B or C would be in addition to smoke and dust associated with development activities on private lands, recreational use of federal and state lands, and prescribed burning on federal or industrial private lands. All major burners operate under the requirements of the Montana Airshed Group that regulates the amount of emissions produced cumulatively to avoid exceeding air quality standards. Cumulative effects during peak burning periods may affect nearby residents for short durations. Project related traffic during dry periods in addition to current road users may affect nearby residents for short durations, as well.

Potential Timber Conservation License
An application has been submitted for a 'timber conservation license in lieu of sale' that may be issued in conjunction with either action alternative. The potential timber conservation area is approximately one acre in size within proposed harvest unit B1. Due to the location and minor extent of the timber conservation area, neither positive nor negative foreseeable impacts to vegetation resources in the Foothills Project Area would be

expected to occur if the 'timber conservation license in lieu of sale' is accepted. Therefore, as a result of the acceptance of the 'timber conservation license in lieu of sale' there would be no additional direct, indirect, or cumulative impacts to old growth, vegetation attributes, sensitive plant, or noxious weeds.

4.7 PREDICTED EFFECTS ON AESTHETICS

No Action Alternative A – Direct, Indirect, and Cumulative Effects to Aesthetics
In the short term, there would be little change to the current views of the project area. Small trees and shrubs would continue to grow and tend to limit views from open roads. No indirect effects to aesthetics were determined as a result of the No Action Alternative. No other major projects are planned within the project area in the next 5 years. Some stands may be pre-commercially thinned which would open up the stands and increase sight distance. Any salvage operations would have little effect on aesthetics.

Alternative B – Direct and Indirect Effects to Aesthetics
This alternative would harvest approximately 1468 acres and change the current view on these acres. Regeneration harvests would occur on 843 acres. Views would be very open with the majority of the overstory being removed. 625 acres would have intermediate harvest and have a more mosaic overstory. Views would be more open than current views. Approximately 1.1 miles of new road would be constructed and 1.8 miles of temporary roads would be constructed. Temporary roads would be reclaimed upon the completion of harvest activities and would have little effect on aesthetics. New road construction would be at least partially visible and would remain visible until the regeneration became established and tall enough to obstruct the view of the new roads. Some visual screening will be left along roads as appropriate to comply with grizzly bear security concerns. This would also limit views into the project area.

Alternative C – Direct and Indirect Effects to Aesthetics
This alternative would harvest approximately 1156 acres and change the current view on these acres. Regeneration harvests would occur on 531 acres. Views would be very open with the majority of the overstory being removed. 625 acres would have intermediate harvest and have a more mosaic overstory. Views would be more open than current views. No new roads would be constructed and 1 mile of temporary roads would be constructed. Temporary roads would be reclaimed upon the completion of harvest activities and would have little effect on aesthetics. Some visual screening will be left along roads as appropriate to comply with grizzly bear security concerns. This would also limit views into the project area.

Alternatives B and C – Common Direct and Indirect Effects to Aesthetics
Timber harvesting would change the current view and aesthetics of stands by removing overstory trees, creating logging slash and debris in landings and on skid trails, causing some damage to remaining vegetation, and soil disturbance on skid trails if logging occurs during non-winter months. Views into the harvested units would be more open and sight distance would be increased. In some instances, views may be open enough to see through the entire stand. Most of the prescribed timber harvest would try to emulate a mixed severity to stand replacement fire. As a result, harvest units would be quite visible from open roads and other vantage points that provide views into the project area.

Alternatives B and C – Common Cumulative Effects to Aesthetics
There are no other major projects planned within the project area within the next 5 years. Some small pre-commercial thinnings may occur but would have little affect on views into the treated stands. Natural disturbances such as wildfires, blowdown, insect and disease outbreaks could occur over time and change the view of the project area. Any subsequent salvage operations would alter the view by removing dead and dying trees, damaging some residual vegetation, and causing some ground disturbance. Ongoing activities such as firewood gathering and recreation would alter some views on a very small scale.

Potential Timber Conservation License
An application has been submitted for a 'timber conservation license in lieu of sale' that may be issued in conjunction with either action alternative. The potential timber conservation area is approximately one acre in size within proposed harvest unit B1. Due to the location and minor extent of the timber conservation area, neither positive nor negative foreseeable impacts to aesthetics in the Foothills Project Area would be expected to occur if the 'timber conservation license in lieu of sale' is accepted. Therefore, as a result of the acceptance of

the 'timber conservation license in lieu of sale' there would be no additional direct, indirect, or cumulative impacts to aesthetics.

4.8 PREDICTED EFFECTS ON RECREATIONAL USE

No Action Alternative A – Direct, Indirect, and Cumulative Effects to Recreational Use
Current types of general recreational use would continue in the Foothills Timber Sale project area. Amount of use would continue at the same level or slightly increase as the population in close proximity to the project area grows. Revenue may increase from this use, but is expected to be slight. Vandalism associated with illegal or unauthorized recreational activities would continue to cause resource damage to various sites, and may increase with the population growth, too. Road status of open or restricted roads and use would not change in the immediate future, but efforts to improve road closure effectiveness would continue as funding allows. Continued deterioration of roads in the project area or continued breach of restrictions may hinder the use of these roads for groomed ski trails to the point that it is not feasible, then a slight loss in revenue may occur. However, it is more likely that cooperation between various user groups would increase and revenue would continue at the same level or slightly increase in the long term.

Alternatives B and C – Common Direct and Indirect Effects to Recreational Use
Recreational use in the Foothills Timber Sale project area may change, especially during periods of active timber harvesting. Lower levels of use may occur as recreational users choose to avoid logging activities. Project related road construction, improvements, and restrictions would reduce the amount of connecting roads and trails in the project area with the addition of road closure devices and by incorporating slash in road and skid trail prisms not scheduled for long term or continual access. Fewer easy travel routes would be available for recreational use, and may result in lower levels of vandalism. Up to 6 parking areas would be constructed or improved to provide better non-motorized access within the project area. These areas are located along Foothills County Road and the Jewel Basin Road. This disruption or displacement of use in the project area is not expected to affect revenue from general recreational use licenses, or Montana Conservation Licenses.

The Nordic ski special use license would probably be disrupted or restricted to a shorter trail system during active timber harvesting. Post harvest use for this purpose would require development of a different trail system and may require more pre-season trail preparation work for segments closed with slash and debris. These changes may result in a short term or long term loss of special use revenue. With improved effectiveness of road closures, a reduction of loop roads, and potentially greater snow accumulation in more open stands long term special use revenue may increase.

Alternative B - Direct and Indirect Effects to Recreational Use
Silvicultural treatments would be applied to 30% of the Foothills project area under Alternative B, and includes approximately 8 more miles of road management work associated with project implementation than Alternative C. Disruption or displacement of recreational use may be endured for longer periods or would effect a larger portion of the project area than under Alternative C. The restricted 34A road under this alternative would provide 2 more miles of road for traditional non motorized use than Alternative C. However, effects to revenue are not expected to differ from those discussed under direct and indirect effects common to both alternatives.

The timber harvest unit boundary for BC2, follows or includes approximately 1200 feet of the USFS trail in Section 2. Hikers may be restricted from use for a day or delayed during felling and skidding operations adjacent to the trail. Some hikers may be intolerant of the noise or the aesthetics of the forest after logging and choose not to use the trail. Measures to protect the trail tread from logging damage would include winter logging, or covering the trail with slash and using a designated crossing, and whole tree skidding adjacent to the trail to avoid slash accumulations on or near the trail. These effects would not diminish the recreational use fees or the rights of use previously granted.

Alternative C - Direct and Indirect Effects to Recreational Use
Silvicultural treatments would be applied to 24% of the Foothills project area under Alternative C, and requires approximately 8 less miles of road management work associated with project implementation than Alternative B. Disruption or displacement of recreational use may be endured for shorter periods or would effect a smaller portion of the project area than under Alternative B. The restricted 34A road under this alternative would provide

2 less miles of road for traditional non motorized use than Alternative B. However, effects to revenue are not expected to differ from those discussed under direct and indirect effects common to both alternatives.

Alternatives B and C – Common Cumulative Effects to Recreational Use

Implementation of the action alternatives may result in increased levels of recreational use on adjacent USFS lands in the Jewel Basin Hiking Area and motorized trails in the Peters Ridge area. This displacement of users is not expected to diminish current levels of trust revenue from recreational use fees, and may result in an increase in the long term.

Potential Timber Conservation License

An application has been submitted for a 'timber conservation license in lieu of sale' that may be issued in conjunction with either action alternative. The potential timber conservation area is approximately one acre in size within proposed harvest unit B1. The area would continue to be available for current recreational uses. Due to the location and minor extent of the timber conservation area, neither positive nor negative foreseeable impacts to recreational use in the Foothills Project Area would be expected to occur if the 'timber conservation license in lieu of sale' is accepted. Therefore, as a result of the acceptance of the 'timber conservation license in lieu of sale' there would be no additional direct, indirect, or cumulative impacts to recreational use.

4.9 PREDICTED EFFECTS ON ECONOMICS

Three options are being analyzed in this Environmental Impact Statement: Alternative A) No Action, Alternative B) which includes a harvest of an estimated 63,369 tons of timber, and Alternative C) which includes a harvest of an estimated 48,606 tons of timber. The following estimates are intended for relative comparison of alternatives and not intended to be absolute estimates of returns, taxes, employment or wages.

No Action Alternative A – Direct Effects to Economics

If the no action alternative were followed, none of the estimated employment, income, or Trust Fund effects that result from the action alternatives would occur.

No Action Alternative A – Cumulative Effects to Economics

The Department of Natural Resources and Conservation has a statewide sustained-yield annual harvest goal of 53.2 million board feet. If timber from this project is not sold this volume could come from sales elsewhere, however, the timber may be from other areas and not benefit this region of the state. Long-term deferral of harvest from this forest will impact harvest patterns, changing both the region in which the trees are harvested and the volumes taken. This will impact other areas of the state where these changes occur.

Alternatives B and C – Common Direct Effects to Economics

Timber Sale Effects

The estimated revenues and expenditures associated with the Foothills timber sale are shown in Table 4-14. Because there is no timber harvest impact associated with the "no action" alternative, the rest of the analysis will focus on the remaining two alternatives. The two alternatives analyzed may, for administrative purposes, be broken into smaller sales but are treated as a unit for the purpose of this analysis. The volume associated with Alternative C is 48,606 tons or 7.1 mmbf (million board Feet). The corresponding volume for Alternative B is 63,369 tons or 9.3 mmbf. The areas associated with each alternative are identified in figures 2-1 and 2-2 in Chapter 2 of this EIS.

Table 4-14
Estimated Revenues and Expenditures from the Foothills Timber Sale*

	Alternative B	Alternative C
Harvest Volume	63,369 Tons	48,606 Tons
Stumpage price $/Ton	$38.30	$37.20
Forest improvement Fee	$181,720	$139,390
Stumpage Revenue	$2,427,040	$1,808,160
Trust Income	$1,235,730	$922,520
State Income	$2,608,760	$1,947,540
Expenditures	$1,373,030	$1,025,020

Source: Montana Department of Natural Resources and Conservation, Trust Land Management.
* The State does not identify expenses for individual timber sales. The estimates used here are based on area/state-wide averages.

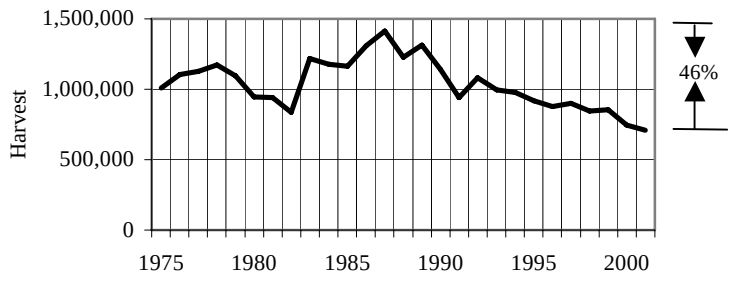
Table 4-15
Number of Students Supported by One Years Estimated Revenue

	Alternative B	Alternative C
Estimated School Revenue	$1,235,730	$922,520
Students Supported*	175	130

Source: Montana Department of Natural Resources and Conservation, Trust Land Management
*Assumes all of the "trust" income will be distributed for educational purposes. Depending on the trust, some of the income is distributed to a fund that earns revenue for future education funding.

Table 4-15 shows the difference in revenue to the trusts from the two action alternatives. The School Trust income from a sale under Alternative C is estimated to be $922,520 enough to fund the education of 130 students for 1 year based on an average cost of $7,080 per Student per year as determined from information provided by the Montana Office of Public Instruction. If the sale does not take place, no students are benefited. Thus, one of the "costs" of not harvesting the timber compared to harvesting under Alternative C is the loss of revenue that could support 130 Kindergarten through grade 12 students for a year. If the Trust does not fund these students through the sale of timber, funding must come from other sources, primarily property taxes.

Figure 4-4
Total Timber Harvest From Montana Forests
(mbf)



Source: Montana Department of Natural Resources, Forest Management Bureau

The School Trust income from a sale under Alternative B is estimated to be $1,235,730 enough to fund the education of 175 students for 1 year based on an average cost of $7,080 as determined by information provided by the Montana Office of Public Instruction. This information is shown in Table 4-15. If the sale does not take place no students are benefited. A "cost" of not harvesting compared to harvesting the timber under Alternative B is the loss of revenue that could support 175 Kindergarten through grade 12 students for a year.

Timber Related Employment

Timber harvesting generates employment. Keegan et al[1] estimate that on average 10.58 jobs are created for every million board feet of timber harvested. Both economic theory and empirical analysis suggest that the marginal effect of an increase in the timber harvested is likely to be different than the average effect because of increasing returns. The marginal effect may be larger or smaller than the average. Empirical evidence would suggest that in a growing industry marginal effect on employment is likely to be smaller than the average. In a contracting industry, the marginal effect on employment could be either larger or smaller than the average. In most cases the marginal effect of increased or decreased timber sales is "lumpy", i.e. two sales of the same size under different conditions might induce a larger than average employment response in one case and a smaller than average employment response or nearly negligible employment response in another.

Figure 4-4 shows that the amount of timber being harvested in Montana has declined since 1987. The decrease in the harvest since the peak of 1,411 million board feet in 1987 has been nearly 50% to 710 million board feet in 2001. Mills, such as the Louisiana-Pacific mill in Belgrade, have closed citing a lack of available timber as part of the cause of their closure. All of these point to an industry declining in size. Based on the previous discussion, the assumption of the average induced employment of 10.58 jobs per million board feet is reasonable. Because the exact conditions of this sale are unknown, the best estimate of employment, i.e. the average effect on employment should be used since it is the best estimate available and the marginal effect of the sale is unknown.

Table 4-16
Foothills Timber Sale
Direct Employment and Income Impacts

	Alternative B	Alternative C
Direct Employment	99	76
Wages & Salaries	$3,881,700	$2,977,400

A ratio of 10.58 jobs per million board feet of wood harvested implies the direct generation of between 76 and 99 jobs and between $3.0 and $3.9 million in wages for each alternative as shown in Table 4-16. The wages are based on an average wage of $39,370 using the data in Table 3-16 in Chapter 3. These are the estimated wages

[1] Keegan, Charles et al, 1995, Montana's Forest Products Industry, A Descriptive Analysis, 1969-1994

that directly result from the timber harvest. Without a timber harvest, income will be lost to the State and communities. Wages in the timber industry are higher than average. This allows individuals working in the industry to obtain higher than average ownership of real personal property. Since much of the revenue for school funding comes from property taxation, higher levels of real property ownership should also provide for better school funding.

In addition to these jobs, additional employment is created when the income earned within the timber industry is spent to purchase goods and services elsewhere in the economy. There are also impacts from the logging companies and timber mills when they purchase goods and services from the local economy. Both of these effects are important since they support other community businesses such as grocery stores, clothing stores, gas stations, etc. The loss of the income from this sale would mean not only the loss of the direct income but the loss of the indirect income as well.

The economic impact on the schools occurs through ways other than the direct contribution to the School Trust Fund from the revenue generated through timber sales. The wood industry pays taxes on the facilities it owns and operates. In the year 2000,the wood industry paid estimated taxes of over $1,860,500 to the schools in Flathead and Missoula Counties. The tax contribution, however, may decline in the future if more mills such the American Timber Company in Flathead County close. The closure of this mill will reduce the tax base by an estimated $4.4 million, thereby reducing the annual property taxes received by the school district by about $28,500. This is a permanent reduction in school funding for over 4 students per year.

Alternatives B and C – Common Indirect Effects to Economics

Indirect economic impacts are much broader than those identified above. Some of these impacts are the result of the money from the sales "recycling" through the economy several times. For example, the money spent for groceries by the employee of the timber mill in part goes to pay the salary of the grocery store employee, the grocery store employee's use that money to purchase groceries for themselves. This in turn generates more income for the grocery store employees, etc. Unfortunately, a model of the county that could be used to demonstrate secondary effects is not available. In a broader statewide context, money paid to wood industry workers results in increased state income tax collections as well as increased purchases in other areas of the State. Income tax collections from the wages of mill workers alone are estimated to generate between $115,000 and $152,000 in state tax revenue, depending on which alternative is selected. Taxes on indirect wages would add to this tax amount. Since the state revenue is spent on projects statewide, the entire state shares, in part, in the benefits that result from the timber sale. In particular, Montana trusts benefit additionally by the being able to use these revenues to fund schools throughout the state.

Non-market Issues

Quantitative analysis of the economic value of non-market benefits and costs will not be part of this analysis because they do not generate income for the trust, although they do affect the well being of Montana residents. Because of their effects, a short qualitative discussion of non-market issues follows:

A brief description of the biological impacts is included in order to identify areas where economic values might be affected. A more detailed discussion of the biological impacts is found in other sections of the report.

- Environmental modifications - The harvest of the timber would modify the undisturbed development of the forest and as a result will affect both the short and long term habitat and wildlife regimes. How individuals value these modifications is an empirical question whose net value may be viewed either positively or negatively by different individuals. Modifying the undisturbed development of the areas will likely limit the use of the area by some species of wildlife in the short run and potentially limit the use by other species in the longer term. Wildlife impacts from the logging activities are expected to be temporary and comparatively small. The estimation of the net social benefit or loss of these impacts is an empirical issue that does not directly affect the School Trust Fund.

- Human use – While the use of these areas is likely to decline or change during the period of logging, long term overall use of the area is expected to remain high. Some non-market uses are unlikely to change. Fishing, for example, should not be severely affected by the logging since SMZ laws protect streams. The aesthetics will be modified and some individuals will view this as a loss, others may prefer the more open forest that will result from the harvest. Visual changes are minimized to the extent practicable by limiting the trees harvested in some areas and by "sculpting cuts" to avoid "unnatural" visual lines. Some activities may be enhanced. For instance

the logged area may enhance the habitat of some game species and the increased use of areas by those game species may make the area more attractive to hunters. As in the case of the environmental modifications, the net social benefit or loss is an empirical issue dependent on individual values.

Social Impact

The area has a substantial presence in the wood processing industry and as a result has institutions established to handle the social requirements associated with this industry. The timber sale is unlikely to add sufficient pressures to these institutions to require their modification. A high rate of employment (low rate of unemployment) is associated with lower rates of crime, domestic violence, alcohol/drug problems and a healthier, more satisfied community. To the extent that the no action alternative might contribute to unemployment, the social impact of the harvest might be a short-term negative social impact on the community. Conversely, to the extent that the sale provides employment the short-term impact will be positive.

Roads

New roads are to be constructed for the sale(s). Existing roads will be improved to handle the logging trucks and provide transport for other equipment used in logging. Expenditures for road improvements are identified in both alternatives as part of the sale development cost. Some improvements are also funded through forest improvement fees as well as other funds set up for this purpose. To the extent that these expenditures are spent locally they will improve local economic conditions. A portion of the money will leave the area and provide income for other areas of the state and national economies. The culverts used in road construction usually come from manufacturers outside of Montana, however, most of the road improvement expenditures will remain in Montana.

Population Impacts

Logging and milling activities associated with the timber sale are not anticipated to have any long-term impact on the population of the region or the State of Montana.

Underlying Assumptions

Project impact estimation and analysis assumes that most of the economic impact associated with the sales will take place in the two county area. The estimates are intended for comparative purposes and do not purport to be the value of the impacts in any absolute sense. Stumpage prices were determined using the current transaction equation modified by professional judgment to reflect current and local market conditions as much as possible.

The Forest Improvement fee is for a program to provide funding for forest development and improvement and is collected from the logging company as part of their bid. Activities funded under this program include site preparation, tree planting, thinning, roadwork, right-of-way acquisition, etc. The current Forest Improvement fee for the Northwest Land Office area is $19.50 per mbf.

Most of the economic impacts associated with this sale are short term. If no other trees were available for harvest after these sale(s), the tendency would be to return to a lower level of economic activity. A short-term impact that might occur as the local economy contracts might be an increase in unemployment as local employers adjust to the lowered production levels.

Alternatives B and C – Common Cumulative Effects to Economics

This sale will be part of the annual harvest of timber from the State of Montana Forest Trust Lands. The net revenue from this sale will add to the trust fund. Annual Trust Fund contributions have varied widely over the years, because the actual contribution to the trust is more a function of harvest than of sales. Harvest levels can vary substantially over time; sales tend to be more consistent. Table 4-17 shows the annual revenue from harvest for the last 5 years. The net contribution to the trust fund is also affected by the annual costs experienced by the Department for program management, which varies year to year. The Department should continue to make net annual contributions to the trust from its forest management program.

Table 4-17
Annual Revenue from Timber Harvested from Montana Trust Lands

Year	Harvest Revenue
2004	$11,043,525
2003	$8,270,589
2002	$9,699,034
2001	$8,524,150
2000	$12,710,311

Timber Conservation License in Lieu of a Sale Application
An application for a Timber Conservation License in Lieu of a Sale has been made for approximately 1.2 acres of timber on the Bear Creek parcel of the sale. The average cut per acre on this parcel has been estimated to be 9,048 board feet or about 62 tons per acre. Based on the estimated revenue per ton of $38.30 and $37.20 for alternatives B, and C, respectively, the additional revenue for the conservation license is expected to be $283 for Alternative B and $275 for Alternative C. These estimates are based on receiving approximately 10% more revenue for the timber in the conservation license than the timber in the rest of the sale area. In addition some even smaller amount will be realized when the stand is next entered at the end of the Timber Conservation License. This next entry into the stand is expected in 20 years.

4.10 PREDICTED IRRETRIEVABLE/IRREVERSIBLE COMMITMENTS OF RESOURCES

Irretrievable commitments of resources result in a loss of production or use of a resource for a period of time. The action alternatives would remove mature, overstory trees in the stands scheduled for harvest. These trees would not be available to provide wildlife habitat, structural stand diversity, woody debris recruitment, or future opportunities for timber harvest. New road construction in Alternative B would convert land from timber production to roads.

Irreversible commitments of resources result in a use of non-renewable resources, or modification of resources that can be renewed only after a long period of time. The resource commitment of harvesting of trees and the construction of new roads are not irreversible. Planting of new trees and natural regeneration will establish a new stand of trees that is comparable to the stands that were harvested. Tree size and density would be very similar to the current condition once the stand is fully regenerated and allowed to develop into a mature age class. Road prisms could be reclaimed by re-contouring and re-vegetating. Reclaimed road prisms could be put back into timber production and grow similar stands of trees that were present prior to road construction.

4.11 SHORT TERM VERSUS LONG TERM PRODUCTIVITY

Short term productivity normally refers to an annual yield of resources. It could also refer to the productivity of a particular resource over a specified time (e.g. 1 to 3 years). Long term productivity generally refers to a piece of land's ability to produce resources in perpetuity.

The proposed action alternatives are designed to promote the long term productivity of the treated stands. Growth, vigor, and health of residual stands would be improved and increase stand productivity in the short term and long term. Post harvest stands would provide future opportunities for timber harvest and other uses.

CHAPTER 5: REFERENCES

5.1 LIST OF PREPARERS

Beverly O'Brien	Forest Management Supervisor (retired) DNRC, Kalispell Unit
Pete Seigmund	Forest Management Supervisor DNRC, Kalispell Unit
James Bower	Fisheries Biologist DNRC, Forest Management Bureau, Missoula MT
Paul Engelman	Economist DNRC, Forest Management Bureau, Missoula MT
Norm Merz	Wildlife Biologist DNRC, Northwestern Land Office, Kalispell MT
Tony Nelson	Hydrologist DNRC, Northwestern Land Office, Kalispell MT
Sarah Pierce	Planner DNRC, Forest Management Bureau, Missoula MT

5.2 AGENCIES AND PERSONS CONSULTED

Patrick Rennie	Archaeologist DNRC, Agriculture and Grazing Management Bureau, Helena, MT

5.3 LITERATURE CITED

Agee, J.K. 1998. The landscape ecology of Western forest fire regimes. Northwest Science 72 (special issue): 24-34.

Amaranthus, M. 1998. The importance and conservation of ectomycorrhizal fungal diversity in forest ecosystems: Lessons from Europe and the Pacific Northwest. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-431. 15pp.

Antos, J.A., and Habeck, J.R. 1981. Successional development in *Abies grandis* (Dougl.) Forbes forests in the Swan Valley, western Montana. Northwest Science 55: 26-39.

Aney, W. and R. McClelland. 1985. Pileated woodpecker habitat relationships (revised). Pages 10-17 *In* Warren, N. eds. 1990. Old growth habitats and associated wildlife species in the Northern Rocky Mountains. USFS, Northern Region, Wildlife Habitat Relationships Program R1-90-42. 47pp.

Beschta, R., R. Bilby, G. Brown, L. Holtby and T. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. *In*: Salo, E. and T. Cundy (eds.). Streamside management: forestry and fishery interactions. University of Washington, Institute of Forest Resources, Contribution No. 57. Seattle, WA.

Bilby, R.E. and P.A. Bisson. 1998. Function and distribution of large woody debris. *In* River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer, New York, NY.Bate, L and M.

Wisdom. 2004. Snag Resources in Relation to Roads and Other Indices of Human Access on the Flathead National Forest. Flathead National Forest, Kalispell, MT. 28pp.

Bunnell, FL, M. Boyland, and E. Wind. 2002. How Should We Spatially Distribute Dying and Dead Wood? Pages 727-754 *in* Laudenslayer, William F., Jr.; Shea, Patrick J.; Valentine, Bradley E.; Weatherspoon, C. Phillip; Lisle, Thomas E., technical coordinators. Proceedings of the symposium on the ecology and management of dead wood in western forests. 1999 November 2-4; Reno, NV. Gen. Tech. Rep. PSW-GTR-181. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 949 p.

Callahan, Paul. 2000. *Forest Road Sedimentation Assessment Methodology*. Land and Water Consulting, Inc.

Daubenmire, R.F. 1967. Plants and Environment. 2nd edition, John Wiley and Sons, Inc., New York. 422 p.

Daubenmire, R. 1975. Plant succession on abandoned fields and fire influences in a steppe area in southeastern Washington. Northwest Science. 49:36-48.

Department of Natural Resources and Conservation (DNRC). 1996. State forest land management plan. Montana Department of Natural Resources and Conservation, Missoula, MT.

DNRC. 2003. Montana Administrative Rules for Forest Management. Montana DNRC Trust Land Management Division, Forest Management Bureau. Missoula, MT. 87p.

DNRC. 2004. Montana DNRC 2004 Annual Report, Trust Land Management Division. http://www.dnrc.state.mt.us/04annualreport/chapters/pdf%20files/04TLMD.pdf

Dickson, JG, Conner, RN, and WJ Howard. 1983. Snag retention increases bird use of a clear cut. Journal of Wildlife Management 47: 799-804

Downs, C.C., R.G. White, B.B. Shepard. 1997. Age at Sexual Maturity, Sex Ratio, Fecundity, and Longevity of Isolated Headwater Populations of Westslope Cutthroat Trout. North American Journal of Fisheries Management. 17:85-92.

Fischer, W.C., and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech Rep. INT-223. USDA Forest Service, Intermountain Research Station, Ogden, Utah. 95 p.

Fish Wildlife and Parks (Montana FWP). 1996. White-tailed Deer Densities and Overall Distribution. Kalispell, Montana. <http://fwp.mt.gov/insidefwp/gis/shapefiles/wtdden.shp.zip>

FWP. 2004. Mule Deer Distribution and Habitat. Kalispell, Montana. <http://fwp.mt.gov/insidefwp/gis/shapefiles/muledr04.shp.zip>

FWP. 1999. Montana Elk Winter Ranges, Summer Ranges, Calving Areas, and Migration Areas. Kalispell, Montana. <http://fwp.mt.gov/insidefwp/gis/shapefiles/elk99.shp.zip>

Fraley, J.J. and B.B. Shepard. 1989. Life History, Ecology and Population Status of Migratory Bull Trout (*Salvelinus confluentus*) in the Flathead lake and River System, Montana. Northwest Science. 63(4):133-143.

Gardner, B. 1997. Flathead National Forest Stream Survey: Birch Creek (Unpublished Report). U.S. Department of Agriculture, Forest Service, Bigfork Ranger District, Bigfork, MT.

Graham, R.T., A.E. Harvey, MF Jurgensen, TB Jain, JR Tonn, DS Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountain. USDA For. Serv. Int. Mtn. Res. Sta. INT-RP-477. 13pp.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old-Growth Forest Types of the Northern Region. USDA Forest Service, Region 1. Missoula, MT.

Griffith, J.S. 1988. Review of competition between cutthroat trout and other salmonids. American Fisheries Society Symposium 4:134-140.

Habeck, James R. 1968. Forest succession in the Glacier Park cedar-hemlock forests. Ecology. 49(5): 872-880

Hansen, P., R. Pfister, K. Boggs, B. Cook, J. Joy, D. Hinckley. 1995. Classification and Management of Montana's Riparian and Wetland Sites. Miscellaneous Publication No. 54. The University of Montana, Montana Forest and Conservation Experiment Station, Missoula, MT.

Harris, R. 1999. Abundance and characteristics of snags in western Montana Forests. Gen. Tech. Rep. RMRS-GTR-31. Rocky Mountain Research Station, Missoula, MT. 19pp.

Haupt, H.F., et al. 1974. *Forest Hydrology Part II Hydrologic Effects of Vegetation Manipulation*. USDA Forest Service, Region 1. Missoula, MT.

IGBC. 1998. Grizzly bear/motorized access management. Interagency Grizzly Bear Committee. 6pp.

Johnson, S. 1984. Home range, movements, and habitat use of fishers in Wisconsin. M.S. Thesis, Univ. Wiscon, Stevens Point. 78pp.

Jones, J.L. 1991. Habitat use of fisher in northcentral Idaho. M.S. Thesis, Univ. Idaho, Moscow, ID. 147pp.

Kendall, K. 2004. Greater Glacier Area Bear DNA Project. http://nrmsc.usgs.gov/research/glac_beardna.htm

Kimball, S. 1998. Sensitive Plant Survey Report. Available at Montana DNRC, Kalispell Unit, 2250 Highway 93 North; Kalispell, MT.

Liknes, G.A. and P.J. Graham. 1988. Westslope Cutthroat Trout in Montana: life history, status, and management. American Fisheries Society Symposium 4:53—60.

Losensky, J. 1997. Historical vegetation of Montana. Contract #970900. Montana DNRC. Missoula, MT. 109pp.

Mace, RD and C Jonkel. 1980. Grizzly bear response to habitat disturbance. *In* CJ Jonkel, ed. Border Grizzly Project, Univ. of Mont., Missoula, MT, Annu Rep. No.1.

Mace, RD and JS Waller. 1997. Demography and trend of a local grizzly bear population in a source-sink landscape. Pages 102-118 *in* Mace, R.D and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains. Montana Fish, Wildlife and Parks, 1920 6th Ave. East. P.O. Box 200701, Helena, MT 59620-0701.

Mace, R., J. Waller, T. Manley, L. Lyon, H. Zuuring. 1997. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. Pages 64-73 *In* Mace, R.D and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains. Montana Fish, Wildlife and Parks, 1920 6th Ave. East. P.O. Box 200701, Helena, MT 59620-0701.

Manley, T. Unpubl. Location of grizzly bear conflict locations. Montana Fish, Wildlife and Parks, Kalispell, MT.

Mattson, R. Dirzo, H. Arita, S. Ryan, E.A. Norse, R.F. Noss, and D. Johns. 1999. Corridors: Reconnecting fragmented landscapes. Pages 129-170 *in* M.E. Soule and J. Terborgh, eds. 1999. Continental Coservation: Scientific foundations of regional reserve networks. Island Press, Washing, D.C.

McClelland, B.R. 1979. The pileated woodpecker in forests of the Northern Rocky Mountains. Pages 283-299 *in* Role of insectivorous birds in forest ecosystems. Academic Press.

Montana Bald Eagle Working Group. 1991. Habitat management guide for bald eagles in Northwestern Montana..

Montana Bald Eagle Working Group. 1994. Montana bald eagle management plan. USDI Bureau of Land Management. Billings, MT. 61pp.

MBTRT (Montana Bull Trout Restoration Team). 2000. Restoration plan for bull trout in the Clark Fork River basin and the Kootenai River basin, Montana. Report prepared for Governor Marc Racicot. Montana Fish, Wildlife and Parks, Helena, MT.

MBTSG (Montana Bull Trout Scientific Group). 1996. Swan River drainage bull trout status report (including Swan Lake.) Report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks, Helena, MT.

MBTSG (Montana Bull Trout Scientific Group). 1998. The Relationship Between Land Management Activities and Habitat Requirements of Bull Trout. Report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks, Helena, MT.

Montana Department of Environmental Quality. "1996 TMDL Query System." 12 December, 2005. http://nris.state.mt.us/wis/tmdlapp/tmdl96.asp .

Montana Department of Environmental Quality. "2004 TMDL Query System." 12 December, 2005. <http://nris.state.mt.us/wis/environet/2004Home.html>

MFISH (Montana Fisheries Information System). 2005. Montana Fish, Wildlife and Parks, Montana Natural Resource Information System.

MNHP (Montana Natural Heritage Program). 2005. Animal Species of Concern. Montana Natural Resource Information System.

Nakano, S., K. Fausch, T. Furukawa-Tanaka, K. Maekawa, H. Kawanabe. 1992. Resource Utilization by Bull Trout and Cutthroat Trout in a Mountain Stream in Montana, U.S.A. Japanese Journal of Ichthyology. 39(3):211-217.

Nation Audobon Society. 2001. The Sibley guide to bird life and behavior. C. Elphick, JB Dunning, Jr., andDA Sibley, eds. Chanticleer Press, Inc, NY. 588pp.

NRIS (Natural Resource Information System). 2004. Westslope Cutthroat Trout Distribution, Swan Drainage, HUC Num: 17010211 (map). Montana State Library, Helena, MT.

OSU Extension Service. Regenerating Oregon's Forest, Oregon State University Extension Service, Corvallis, Oregon, 1982

Ovtos, IS. 1979. The effects of insectivorous bird activities in forest ecosystems: an evaluation. Pages 341-374 *in* Dickson, JG, RN Conner, RR Fleet, JC Kroll, JA Jackson, eds. Proceed. The role of insectivorous birds in North American. Nacogdoches, TX. Academic Press, New York.

Parks, CG and DC Shaw. 1996. Death and decay: A vital part of living canopies. Northwest science. Vol 70, special issue: 46-53.

Peters, R.H. 1983. The ecological implications of body size. Camnbridge: Cambridge University press. *As cited in* Dobson, A, K. Ralls, M. Foster, M.E. Soule, D. Simberolff, D. Doak, J.A. Estes, LS Mills, D.

Pierce, J. and D. Barton. 2001. Sensitive Plant Survey Report. Available at Montana DNRC, Kalispell Unit, 2250 Highway 93 North; Kalispell, MT.

Pfankuch, D. 1978. Stream reach inventory and channel stability evaluation. U.S. Department of Agriculture, Forest Service, Northern Region, Missoula, MT.

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain For. and Range Exp. Sta. Ogden, UT. 174pp.

Powell, R. 1982. The fisher: National history, ecology, and behavoiur. Univ. Minn. Press, Minneapolis. 217pp.

Pratt, K. 1984. Habitat Use and Species Interactions of Juvenile Cutthroat (*Salmo clarki lewisi*) and Bull Trout (*Salvelinus confluentus*) in the Upper Flathead River Basin. Master's Thesis, University of Idaho, Moscow, ID.

Robinson, E.G. and R.L. Beschta. 1990. Identifying Trees in Riparian Areas That Can Provide Coarse Woody Debris to Streams. Forest Science. 36(3):790-800.

Rosgen, David L. 1996. *Applied River Morphology.* Wildland Hydrology, Pagosa Springs, CO.

Scott, VE. 1979. Bird responses to snag removal in ponderosa pine. Journal of Forestry 77: 26-28.

Shepard, B.B., K.L. Pratt, P.J. Graham. 1984. Life Histories of Westslope Cutthroat and Bull Trout in the Upper Flathead River Basin, Montana. Montana Fish, Wildlife and Parks, Kalispell, MT.

Thomas, JW, ed. 1979. Wildlife habitat in managed forests: the blue Mountains of Oregon and Washington. USDA For. Serv. Agr. Handbook No. 553. Pacific For. and Range Res. Sta. Portland, OR. 512pp.

Thomas, J., K. Sutherland, B. Kuntz, S. Potts. 1990. Montana Nonpoint Source Management Plan. Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, MT.

Torgersen, T. 1994. Natural enemies in forest insect regulation. Pages 108-111 *in* Pilarski, M (ed). Restoration Forestry: An international guide to sustainable forestry practices. Kivaki Press.

USDA Forest Service. 1998. *Soil Survey of the Flathead National Forest Area, Montana.* USDA Forest Service and Natural Resources Conservation Service.

USDA Natural Resources Conservation Service. 2004. *Soil Survey Geographic (SSURGO) database for Upper Flathead Valley Area, Montana*. USDA Natural Resources Conservation Service.

USFWS 1987. Northern Rocky Mountain wolf recovery plan. USFWS, Denver, CO. 119pp.

USFWS. 1986. Recovery plan for the Pacific bald eagle. USFWS. Portland, OR. 160pp.

USFWS. 1993. Grizzly bear recovery plan. Missoula, MT. 181pp.

US Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife and Parks, Idoaho Fish and Game, USDA Wildlife Services. 2005. Rocky Mountain wolf recovery: 2004 annual report. D. Boyd, ed. USFWS, Ecological Services, Helena, MT. 72pp

Walankiewicz, W. 1991. Do secondary cavity-nesting birds suffer more from competition for cavities or from predation in a primeval deciduous forest. Natural Areas Journal 11: 203-212.

Waller, JS. 1992. Grizzly bear use of habitats modified by timber management. M.S. Thesis, Mont. State Univ. Bozeman, MT. 62pp.

Waller, JS and RD Mace. 1997. Denning ecology of grizzly bears. Chapter 4 *in* Mace, R.D and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains. Montana Fish, Wildlife and Parks, 1920 6th Ave. East. P.O. Box 200701, Helena, MT 59620-0701.

Welsh, CJE and DE Capen,. 1992. Availability of nesting sites as a limit to woodpecker populations. Forest Ecology and Management 48: 31-41.

Weaver, T. and J. Fraley. 1991. Fisheries Habitat and Fish Populations. Flathead Basin Commission, Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Kalispell, MT.

Wolman, M.G. 1954. A Method of Sampling Coarse River-Bed Material. Transaction American Geophysical Union. 35(6):951-956.

Wright, M. and R.Escano. 1986. Montana bald eagle nesting habitat: a macro-habitat description. USDA For. Serv. Wildlife and Fish Habitat Relationships Program. Missoula, MT. 24pp.

Young, Stephen L. 1989. *Cumulative Watershed Effects*. Lassen National Forest.

Zager, P. 1980. The influence of logging and wildfire on grizzly bear habitat in Northwestern. PhD. Thesis. Univ. of Montana, Missoula. 130pp.

5.4 ABBREVIATIONS AND ACRONYMS

ARM	Administrative Rules for Montana
BMP	Best Management Practices
BT	Bull trout
DBH	Diameter at Breast Height
DEQ	Department of Environmental Quality
DF	Douglas-fir
DFC	Desired Future Conditions
DNRC	Department of Natural Resources and Conservation
E	East
EBT	Eastern brook trout
EIS	Environmental Impact Statement
FWP	Montana Fish, Wildlife, and Parks
HRA	Hazard Reduction Agreement
HW	Hardwood
ID	Interdisciplinary
LP	Lodgepole pine
MBF	Thousand Board Feet
MC	Mixed conifer
MCA	Montana Code Annotated
MMBF	Million Board Feet
MEPA	Montana Environmental Policy Act
N	North
NW	Northwest
PP	Ponderosa pine
R	Range
RT	Rainbow trout
S	South
SAF	Subalpine fir
SE	Southeast
Rules	State Forest Land Management Rules
SMZ	Streamside Management Zone
T	Township
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USFS	United States Forest Service
W	West
WCT	Westslope cutthroat trout
WL	Western larch
WWP	Western white pine